Llandudno North and West Shore

Outline Business Case (OBC)

Conwy County Borough Council

Project number: 60569104

Quality information

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1. Executive summary

1.1 Introduction

The Llandudno Flood Alleviation Scheme (FAS) Outline Business Case (OBC) has identified 'business as usual with the raising of the rear promenade wall before year 50 as the Preferred Option on the North Shore and 'topping up with additional shingle as required' as the Preferred Option on the West Shore. This Combined Option provides up to a 0.5% Annual Exceedance Probability (AEP) (1 in 200 year) event Standard of Protection (SoP) including an allowance for climate change and is the preferred option under the current Welsh Government Guidance. The Preferred Option provides £76,016k of benefits with a 11.32 Benefit-Cost Ratio (BCR), to achieve this the OBC seeks approval of £6,717k of investment to complete detailed design and for construction of the defences. Following approval from the Welsh Government the scheme will progress to Detailed Design and Full Business Case (FBC).

An alternative option has also been identified which reflects the current wishes of the local stakeholders within Llandudno. This option includes beach nourishment with shore connected structures such as fishtail or timber groynes at the North Shore and topping up with additional shingle in combination with the extension of secondary defences between the existing hard defences and the dunes in front of North Wales Golf Club for the West Shore. This combined option provides the same level of benefit as that of the preferred economic option (0.5% AEP SoP including an allowance for climate change and £76,016k benefits over 100 years) however has a lower cost of £23,962k and a subsequent BCR of 3.17.

The two options have been discussed at length with local Cabinet Members who have supported the alternative option due to the winder benefits presented by the sandy beach however recognised the challenges associated with identifying additional funding streams to support this option. Further information on the Cabinet Meeting where this was discussed is included in **Appendix N**. The alternative option is also preferred by the public and Llandudno Coastal Forum following significant levels of consultation. The findings of the consultation which support the alternative option are included in **Appendix M**.

1.2 Strategic case

Llandudno is a town in North Wales, within the administrative area of Conwy County Borough Council (CCBC). The town is located on a peninsula, surrounded by the Irish Sea. The town has a vibrant tourist and commercial industry as well as a number of residential properties. The nature of the 'bowl' shape of Llandudno and its location means it suffers from multiple sources of flooding but particularly tidal and surface water.

There are two coastal frontages at Llandudno, the North Shore, and the West Shore. The two shores play a key role in the town, North Shore is the main tourist beach within Llandudno and the West Shore is used more regularly by local people as well as providing amenities for tourists. For CCBC tourism accounts for over a quarter of jobs and £888 million to the local economy each year. The accommodation and food services sector accounts for 12.4% of the proportion of businesses within the county[1]. Hydraulic modelling has indicated that the current infrastructure provides up to 1 in 200-year SoP in the present day but is overwhelmed when the impact of climate change is assessed. Therefore, this OBC assesses options to provide protection against the impacts of climate change.

Consultation has been a key part of the development of the OBC. The Llandudno Coastal Forum has provided input from the beginning of the scheme, November 2017, with the aim of finding a preferred option that reduces flood risk, whilst appreciating the views and concerns of local residents and business owners. The tourism strategy, commissioned as part of the OBC, highlights the revenue and value of this industry to Llandudno and the importance of the North and West Shore to visitors of Llandudno.

Environmental assessment has been carried out as part of the development of the OBC, with the findings summarised in the Environmental Appraisal Report (EAR) (**Appendix C**). This includes, but is not limited to, the assessment of landscape, ecology, and heritage. These assessments have helped to identify key constraints and opportunities associated with a FAS in Llandudno. A number of consents and approvals will be required to ensure appropriate mitigation of environmental constraints, including a Marine Management Organisation (MMO) licence and any required protected species licences. These are explored further within the OBC.

[1] Conwy County Borough Council (2019) Monitoring the economy: research bulletin March 2019. [online] Available from https://www.conwy.gov.uk/en/Council/Statistics-and-research/Economy/Monitoring-the-economy-in-Conwy-County-Borough.aspx. Accessed 18/12/2019

1.3 Economic case

The findings of the Beach Management Plan (BMP) were reviewed as part of the long listing process and the long list was agreed at the beginning of the project. A review against the Critical Success Factors (CSF) for the project and through consultation with the Llandudno Coastal Forum, the short list of options was identified to take forward for further assessment.

A total of 3868 residential and 1439 commercial properties are at risk from flooding from both the North Shore and the West Shore at the end of the appraisal period (0.5% AEP event plus climate change) therefore flood risk management measures will need to be considered on both shores to adequately protect the community of Llandudno from the impacts of climate change. Therefore, the short list of options for the North and West Shore have been considered in combination, to identify the economically leading option for both shores.

A Do Nothing, walkaway scenario has been considered to assess the baseline flood risk to Llandudno. The short list of options has been assessed against this baseline. A 'business as usual' option has been assessed as well as three Do Something options for both the North and West shore. A summary of the Do Something options has been provided in **Table 1-1.**

Table 1-1:Short Listed Options

Reference	Scenario	Description
Walkaway	Walkaway	Required in accordance with WG business case guidance. All maintenance and beach monitoring would cease. Over time the defences would begin to fail, and the beach levels would drop causing an increase in overtopping and in the long term flooding from still water levels.
Business As Usual	Business as usual	Required in accordance with WG business case guidance. This would maintain the present sand beach at Children's Corner and the cobble beach between the Trevor Street slipway and the paddling pool.
North Shore - Do Something 1	Beach nourishment with shore connected structures such as fishtail or timber groynes.	At the western end, part of the cobble beach would be replaced with sand; further work would be required to determine the optimum arrangements. Rock groynes were considered as Do Something 1a and timber groynes were considered as Do Something 1b. Although timber groynes appear to be preferable considering feedback from the Llandudno Coastal Forum, Do Something 1b has been taken forward for assessment as it is considered to be a more robust and reliable option. However, the form of control structure would be dependent on the beach arrangements. With rising sea levels, the rear wall will need to be raised to minimise the risk of flooding from overtopping due to climate change. Ad hoc repairs to the existing defences would be required as part of this option.
North Shore - Do Something 2	Beach nourishment alone	Part of the cobbled beach would be replaced with sand to the western end of the frontage. However, with no control structure in place, ongoing beach maintenance could become a liability e.g. increased frequency of beach recycling and/or topping up.

		With rising sea levels, the rear wall will need to be raised to minimise the risk of flooding from overtopping due to climate change. Ad hoc repairs to the existing defences would be required as part of this option.
North Shore - Do Something 3	Business as usual with the raising of the rear promenade wall before year 50	If beach levels are maintained to their current standard (0.5% AEP) then the beach will act as the primary flood defence however with rising sea levels the rear wall will need to be raised in order to minimise the risk of flooding from overtopping. Ad hoc repairs to the existing defences would be required as part of this option.
West Shore - Do Something 1	Periodic beach maintenance	Business as usual but to include topping up with additional shingle, as required. Ad hoc repairs to the existing defences would be required as part of this option. An allowance has been assumed for works undertaken in Year 50 to support the managed realignment recommendation from the Shoreline Management Plan.
West Shore- Do Something 2	Wall extension	Business as usual plus the extension of secondary defences between the existing hard defences and the dunes in front of North Wales Golf Club. Ad hoc repairs to the existing defences would be required as part of this option. An allowance has been assumed for works undertaken in Year 50 to support the managed realignment recommendation from the SMP.
West Shore - Do Something 3	Combined scheme	Implementation of Do Something 1 and Do Something 2 including the following environmental improvements: • Provision of new windblown sand control measures such as sand traps or rock layer; and • Provision of a raised or realigned walkway along the southern half of the frontage.

The economically leading option for the North Shore is 'business as usual with rear wall raising in Year 50 (North Shore Do Something 3) and for the West shore it is 'business as usual with the topping up of shingle as required' (West Shore Do Something 1). This option provides a BCR of 11.32 at a cost of £6,717k.

There is an alternative option which is being proposed by the public and local stakeholders within Llandudno. For the North Shore, this involves beach nourishment with shore connected structures such as fishtail or timber groynes ("Do Something 1") and for West Shore a combined scheme of extending the existing wall and beach nourishment ("Do Something 3"). This option provides a BCR of 3,17 at a cost of £23,962k.

1.4 Commercial case

CCBC have commissioned AECOM, under the NPS framework, to undertake a study and review the potential for coastal defence improvements at Llandudno North Wales by availing of funding through the Welsh Governments Coastal Risk Management Programme (CRMP). Whilst the review principally focusses on coastal defence, wider benefits in line with the Well-being of Future Generations (Wales) Act, 2015, have also be considered and recommended where appropriate.

The Flood Risk and Infrastructure (FRI) Team within CCBC will project manage the process building on the experience gained in the delivery of Welsh Government funded coastal projects recently completed along the Conwy coastline. Subsequent to the submission and acceptance of this Business Case by the Welsh Government, the FRI team will seek to procure a suitably qualified and experienced Consultant to undertake the detailed design of the preferred and agreed option.

Once a detailed design has been completed, a Full Business Case (FBC) will be undertaken to provide an updated cost for target setting. If the scheme is still found to be economically viable, acceptance of the FBC will release funding and a tender package for the construction works will be prepared and tendered with suitably experienced contractors.
CCBC will use the NEC suite of contracts to administer the projects – NEC Professional Services Contract (PSC) Option A for the detailed design and NEC Engineering and Construction Contract (ECC) Option A for the construction works. NEC contracts have been used by CCBC on all recent coastal projects and provide flexibility and standardisation in contract preparation and administration.

1.5 Financial case

Welsh Government funding is being applied for through this OBC for 100% funding for the design and development costs and 85% of the scheme construction costs (combination 7, preferred option) (£612k) under the WG Coastal Risk Management Programme 2016 – 2021 for the preferred option.

CCBC have approval to finance the 15% allocation of the overall project budget from internal Council resources and external partners.

CCBC will act as the accountable body for the project and will be responsible for performance and compliance to ensure the activities supported fit within the programme objectives, are value for money and are an efficient use of public resources.

For the alternative option, CCBC would also apply for funding through this OBC for 100% funding of the funding for the design and development costs and 85% of the scheme construction costs (combination 3, preferred option) (£14,386k) under the WG Coastal Risk Management Programme 2016 – 2021 for the alternative option.

1.6 Management case

Building on the lessons learned from the delivery of recent construction projects such as Colwyn Bay Waterfront and the 2014 emergency works, the FRI team will manage and deliver this project on behalf of CCBC. The Project Director shall appoint the Project Manager for the proposed scheme who is responsible for day-to-day development of the project and co-ordinates the actions of the Project Team and external consultants. The Project Manager is responsible for regular communication with the Project Director who in turn reports to the Councils Scrutiny Committee and ultimately the Council Cabinet at key stages during the development of the project.

The detailed design for this project has been procured and will be completed in 2021, along with necessary consent and planning approvals, tender for construction will take place in December 2021 with a construction programme between FY2021 / 2022.

2. The Strategic Case

2.1 Introduction

Llandudno is a town in North Wales, within the administrative area of CCBC. The town is located on a peninsula, surrounded by the Irish Sea. The town has a vibrant tourist and commercial industry as well as a significant number of residential properties. In the 2011 UK census the town had a population of 20,701[2]. Plans of Llandudno are located below in **Figure 2-1** and **Figure 2-2**. The topography of the peninsula forms the 'bowl' shape of Llandudno and its location lends to it suffering from multiple sources of potential flooding but particularly tidal and surface water.

There are two coastal frontages at Llandudno, the North Shore, and the West Shore. The two shores play a key role in the town, North Shore is the main tourist beach within Llandudno and the West Shore is used more regularly by local people as well as providing amenities for tourists. For CCBC tourism accounts for over a quarter of jobs and £888 million to the local economy each year. The accommodation and food services sector accounts for 12.4% of the proportion of businesses within the county[3].

The North Shore has a wide promenade along the length of the frontage which provides an amenity area with seating along the top of a rear floodwall, at the back of the promenade. At the western end of the promenade is a Victorian Pier and towards the eastern end there is an amenity paddling/boating pool. Seaward of the promenade is a stepped revetment fronted by an artificially recharged gravel beach.

The West Shore comprises a combination of engineered and natural defences. To the south, fronting land occupied by the North Wales Golf Club, there are sand dunes with marram grass and fencing to reduce windblown sand and the erosion of the dunes. Further north the "public" frontage consists of a stepped concrete revetment with a vertical flood wall set back. In between the golf club and public frontages there is a short low-lying section of land fronted by a natural gravel beach and no artificial defences. The sea wall and dunes are fronted by an artificially recharged upper gravel beach, movement of which is controlled by three fishtail rock groynes along West Shore. The beach is located in the outer reaches of the Conwy estuary and the wider lower sand beach exhibits estuarine features such as sand bars and channels.

[2] https://www.ons.gov.uk/census/2011census [Accessed February 2020]
[3] Conwy County Borough Council (2019) Monitoring the economy: research bulletin March 2019. [online] Available from https://www.conwy.gov.uk/en/Council/Statistics-and-research/Economy/Monitoring-the-economy-in-Conwy-County-Borough.aspx. Accessed 18/12/2019

Figure 2-1: North Shore Location Map

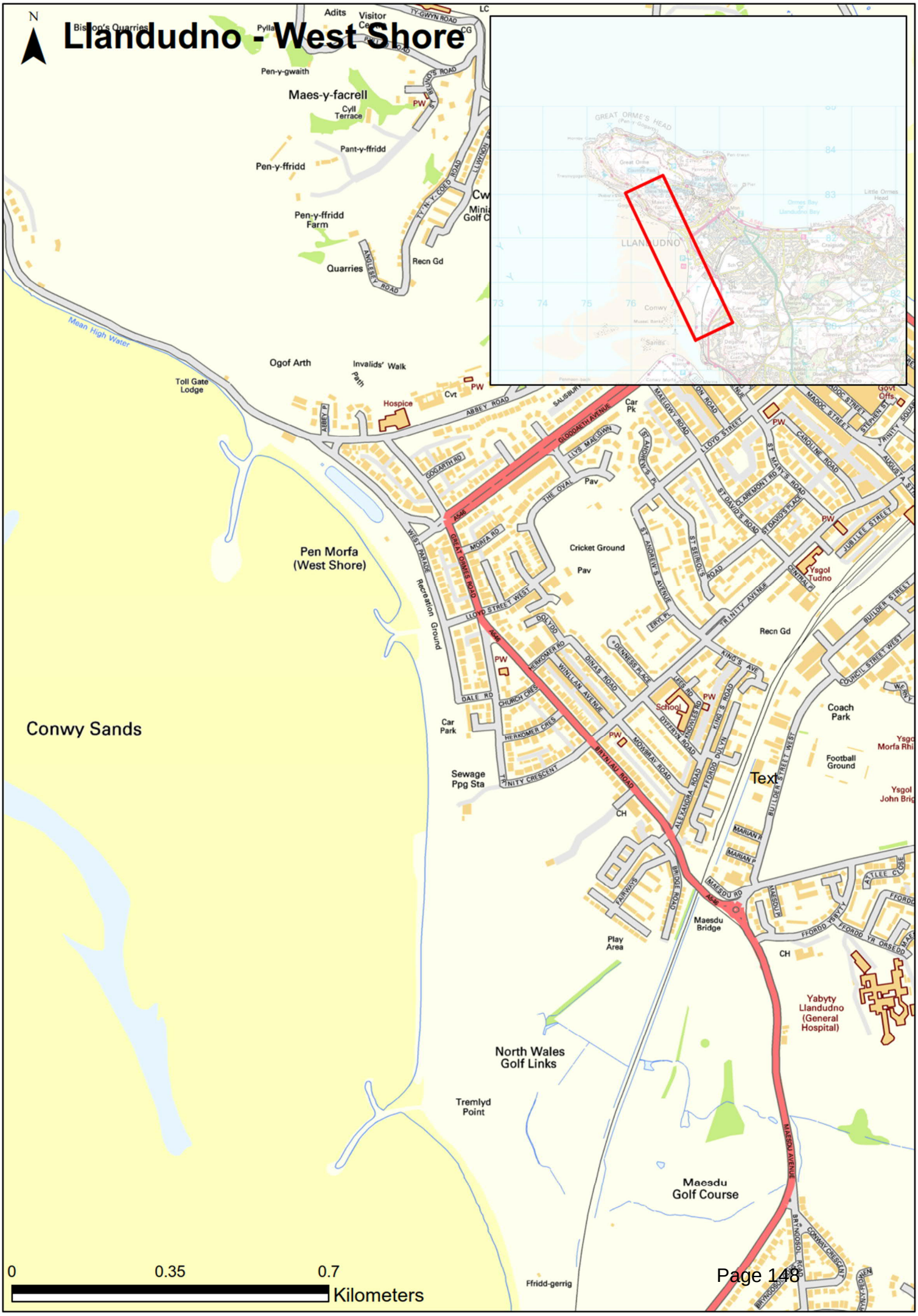

Figure 2-2 West Shore Location Map

2.2 Historical Background and Context

This section summarises the works that have been completed historically to protect Llandudno from tidal flooding and the work undertaken by CCBC to maintain the defences. These defences protect Llandudno from the impact of sea level and wave overtopping flood risk, but it will be overwhelmed in the future due the impact of climate change.

2.2.1 North Shore

Works to protect North Shore have been undertaken since the late 1800s to prevent erosion and reduce the risk of tidal flooding in Llandudno. In the 1930s a new stepped revetment was constructed along St George's Crescent towards Craig-Y-Don and nine timber groynes were installed between the bandstand near Vaughan Street and the current location of the Venue Cymru theatre. Following storm damage in the 1950s the stepped revetment was extended westwards, and an additional four timber groynes installed to the west of the original ones.

By the 1990s the defences were in poor condition and the beach was showing a trend of increasing erosion since the first developments and construction of artificial defences. Following significant flood damage to existing timber groyne field had occurred from storms and lack of maintenance. After significant consultation, a scheme was delivered to repair and modify these defences. The scheme comprised of the importation of a gravel cobble beach in front of the hard defences, repair works to the existing defences and removal of the depleted and dilapidated timber groynes, reconstruction of the promenade with the addition of a flood wall (at the rear between Clarence Road and the Craig-Y-Don pool) and rebuilding of the dwarf wall over the frontage to the west as far as Vaughan Street, which began in 1996. In 2000, these works were extended westwards to Trevor St.

2.2.2 West Shore

The first works at West Shore, to protect against coastal erosion and tidal flooding, were undertaken in the early 1900s. In the 1950s a stepped revetment was constructed with wave return wall and steel sheet piled toe. Following this work, beach levels dropped causing structural deterioration and subsequent overtopping. By the 1980s the beach levels had dropped significantly leading to damage of the structural integrity of the defences. In 1991-1992, three rock fishtail groynes at Gogarth, Lloyd St and Cerrig Duon were constructed, and the upper beach between the structures was reinforced with graded sediment – sand, shingle, and cobbles.

In 2006, the frontage south of the Cerrig Duon breakwater was reinforced with quarried cobble and a section of rock revetment was constructed as part of the national cycle path works across the frontage. A by-product of the stabilised beach since the construction of the groynes has been an increase in windblown sand that has required regular removal from amenity areas, highways, properties, the cycle path, and golf course. In addition, natural dune features have developed at the roots of each of the groynes.

2.3 Baseline Scenario

Hydraulic modelling was undertaken to support the Beach Management Plan (BMP), this information has been used to identify baseline risk and to inform this OBC. The current defences protect Llandudno up to a 0.5% AEP event, although in climate change conditions residential and commercial properties are at risk in a 10% AEP event.

North Shore Baseline Conditions

According to the Llandudno BMP report, the natural shoreline across the North Shore is formed by an upper shingle bank which merges into a lower sand foreshore. The supply of sediment from shoreline erosion has been reduced and almost halted as a result of the construction of artificial coastal defence structures, which alter the shoreline hydraulic regime and have disrupted the natural processes of erosion, transport, and deposition.

Generally, the beach shows a trend of erosion since the first development and the covering up of the natural shingle bank with construction of artificial defences which, although providing the necessary coastal defence function, restricts the interaction between coastal processes and natural shoreline features and exacerbates the erosional trend.

Past flood events have occurred due to low beach levels allowing high energy waves to reach the promenade and overtop the defences, however, since the completion of the 1996/2000 coast protection works the defences have been protected from significant damage and the majority of the wave energy is absorbed by the shingle bank. The overtopping and flood risk assessment is addressed in the Llandudno CTFRA report. This concludes that the North

Shore is protected by a dynamic shingle beach that changes with the incident wave and water level conditions. During high energy events the shingle crest is pushed upwards and backwards, rolling over the existing crest. The presence of the promenade does not allow for the whole beach to roll back therefore shingle is deposited on the promenade. After an analysis performed for MUN3 to MUN6, the primary observation is that the number of times that shingle will be thrown onto the promenade will increase with the effects of climate change.

West Shore Baseline Conditions

Generally, the beach seems to be stable with a slight trend of net accretion. The previous reports (Llandudno BMP and CTFRA) identify cyclical behaviour within sections and overall, across the frontage. Upper sections present a slight trend of accretion whilst lower sections show losses, the latter probably caused by wind-blown sand transport from lower to upper sections. According to existing records on sediment transport presented in the Llandudno BMP, the storm that occurred on the 5th December 2013 reversed the normal behaviour of sediment transport causing an overall increase in the lower beach volume and a slight decrease in the upper beach.

The construction of the breakwaters in the early 1990s has helped to stabilise the upper beach across the frontage by intercepting waves from the predominant direction and therefore blocking wave-induced sediment transport along the frontage. Waves coming from the predominant direction (NW) high enough to bypass the northerly groyne are still able to drive material southwards, some of which is trapped by the Cerrig Duon breakwater at the southern end of the frontage. This was observed in the storm that occurred on 5th December 2013.

Wind-blown sand in some areas of the frontage has been an issue since the breakwaters were constructed, especially for the cycle path where in some areas there is erosion and others show accretion caused by accumulations of wind transported sand from the build-up of material behind the Cerrig Duon breakwater. However, the sand dunes are naturally formed by this process and these provide a proven defence against wave overtopping and inundation at the southern sections of the frontage due to raised crest levels.

The overtopping and flood risk is addressed in the Llandudno CTFRA report which concludes that for the West Shore, the beach levels have a considerable influence on the magnitude of wave overtopping and/or flood risk at the present time. This is demonstrated by assessing the flood risk using the “existing” beach levels and the levels modified by strong storms, as occurred during the winter 2013/2014 storms.

The sand dunes can be considered as a natural defence due to their high crest levels. However, at the northern limit of the dunes, where the natural shingle bank is located, beach crest levels are at the lowest level along the frontage making this point most vulnerable in terms of flood risk. The wave overtopping calculations presented in the CTFRA report support this finding.

Further information on the development of the model and assumptions regarding climate change can be found in BMP and **Appendix H**.

2.3.1 Current and Future Flood Risk

The properties at risk in the present day is summarised in **Table 2-1** and **Figure 2-3**.

Table 2-1 Properties at risk – Present Day

	10 year	30 year	100 year	200 year	1000 year
Residential	0	0	0	124	1807
Commercial	0	0	0	134	705

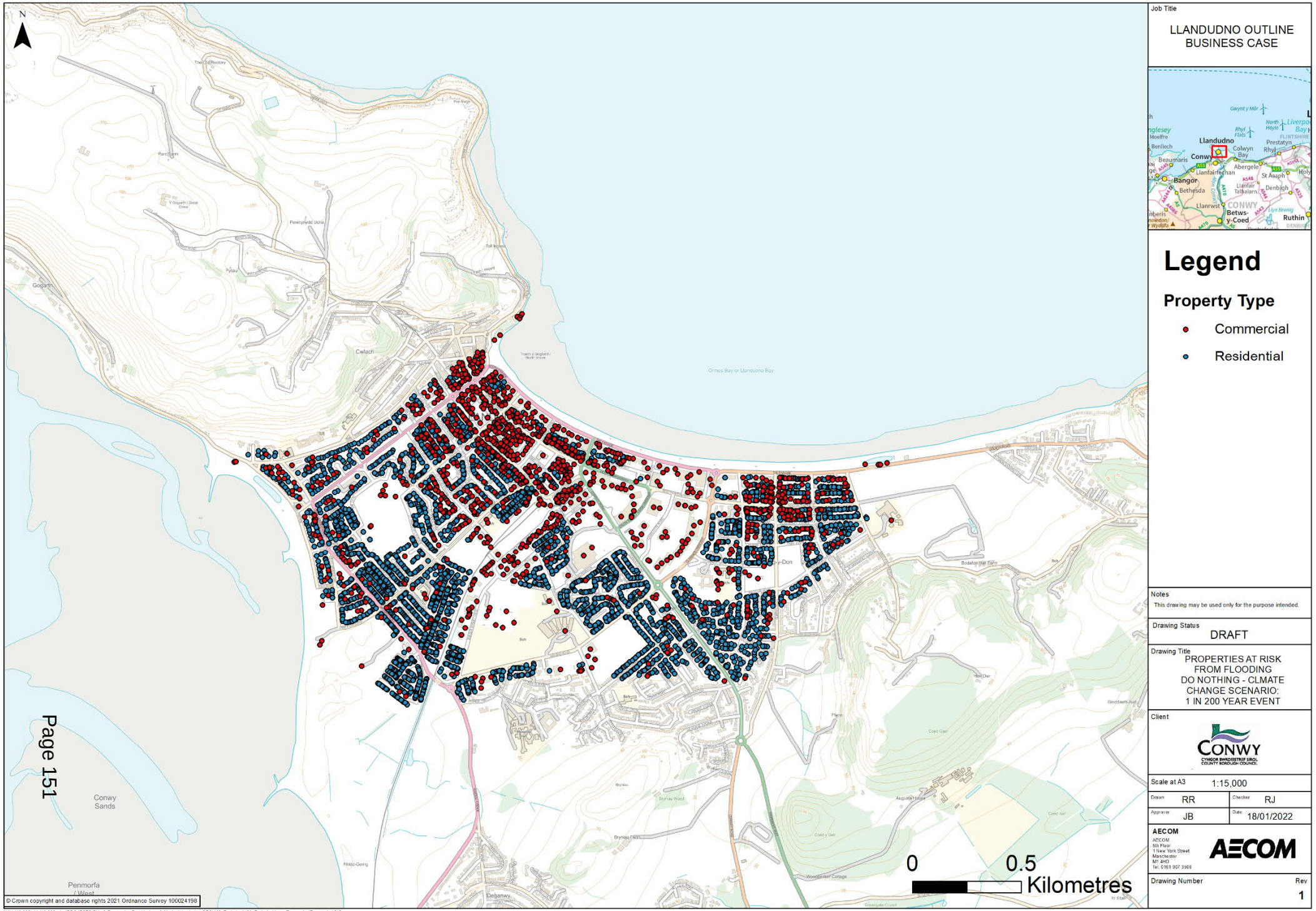

Figure 2-3: Properties at Risk of Flooding in the Do Nothing, Climate Change

The impacts of climate change must be considered in respect of both estimation of the potential future risk and the economic valuation of damages associated with future shoreline management. Climate Change allowances have been calculated data from the UK Climate Impacts Programme 2009 (UKCP09) and Environment Agency guidance document Adapting to Climate Change Guidance (2011). This study has used the Change factor scenario which is based on the 95 percentile projection for the UKCP09 medium emissions scenario. This is consistent with the Llanfairfechan and Llanddulas studies currently being carried out for Conwy County Borough Council as well as the Point of Ayr to West Rhyl Tidal Flood Risk Analysis Modelling currently being carried out for Natural Resources Wales. The assessment has been carried out in relation to future flood risk determination, in accordance with current Welsh Government guidance (Welsh Government, 2012).

Figure 2-4 below indicates the relative sea level rise from 2017 based on the guidance for different emission scenarios. In accordance with the current guidance, the 95th percentile medium emissions change factor which shows a sea level rise of 0.7m in 100 years, shown as the green dashed line on the graph, has been adopted to inform the assessments undertaken.

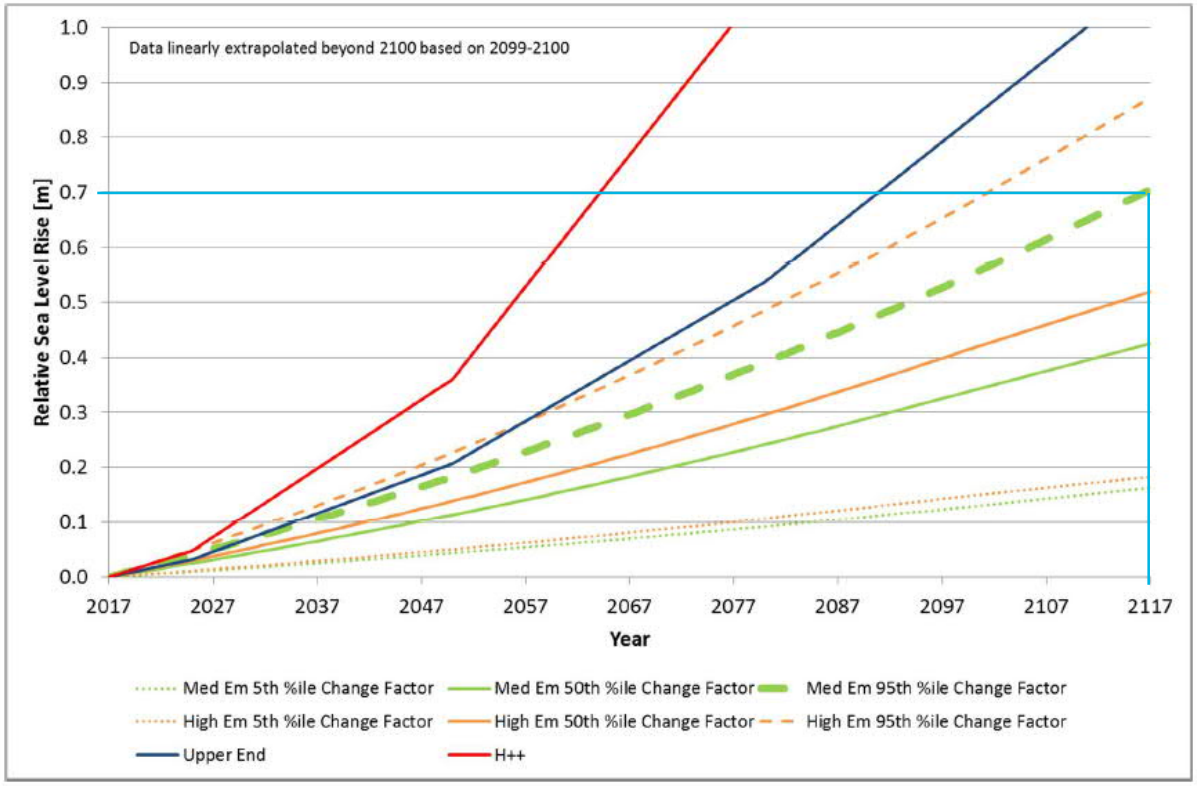

Figure 2-4. Relative Sea Level Rise (m) for Different Emission Scenarios

The standard of flood protection provided by the existing coastal defence arrangements varies with location and the climate change guidance update examined the risk under four scenarios:

- The risk from still water (tide) levels alone with current beach conditions (present day (2017) conditions);
- The risk due to a combination of waves and tide levels under current beach conditions (present day (2017) conditions);
- The risk from still water (tide) levels alone with current beach conditions (in 2117 allowing for predicted sea level rise due to climate change); and
- The risk due to a combination of waves and tide levels under current beach conditions (present day conditions).

The risk was also re-assessed assuming that beach levels were reduced, as occurred following the winter 2013-14 storms.

In all cases the risk of flooding is greater for combinations of waves and water levels, but it should be recognised that there is also a risk from still water level. In terms of flood risk, the still water level only scenarios provide the

minimum risk and the waves + water level scenario provides the maximum risk. A summary of estimated water levels in a 0.5% AEP event and existing defences levels can be found in **Table 2-2**.

Table 2-2 Defence and water level estimates

Shore	Location	Average heights of Defence	Estimated Extreme Water Level (0.5% AEP) – Present Day	Estimated Extreme Water Level (0.5% AEP) – Climate Change
North Shore	Front of the promenade	5.7 – 6.9 mAOD	5.4mAOD	6.1mAOD
	Back of the promenade	6.6 – 7.0 mAOD		
West Shore	Current sea wall	6.0 mAOD		
	Top of the beach - undefended sections	6.5 mAOD		

The properties at risk at the end of the appraisal period, with the inclusion of climate change, is summarised in **Table 2-3 and discussed in Section 1.3..**

Table 2-3 Properties at risk at the end of the appraisal period

	10 year	30 year	100 year	200 year	1000 year
Residential	2150	2637	3770	3868	4083
Commercial	838	1049	1407	1439	1448

Assuming beach levels are actively maintained than the increase in risk as a consequence of climate change and future sea level rise. Therefore, this OBC will focus on developing solutions that are able to manage the increased risks arising from climate change, whilst looking to provide opportunities for wider long-term regeneration of the town.

2.4 Current Coastal Defence Arrangements

Since the current schemes were implemented in the 1990s, CCBC has undertaken frequent visual condition assessments of the defences on both shores and beach levels have been monitored annually with action taken when required. Beach management (re-profiling and topping up of levels along each of the frontages) has been generally undertaken on a reactive “as required” basis. Annual re-profiling occurs between the winter and summer seasons or after a storm event, as demonstrated by the works following the 2013/14 storms.

The winter storms of 2013-14 caused a reduction in beach levels and flooding of the promenade on the North Shore, that was very close to overtopping the secondary wall at the rear of the promenade. In response to the drop in beach levels emergency works were carried out to replenish the gravel cobble that had been lost/displaced, with approximately 30,000m^3 of imported gravel material replaced.

A Visual Condition Survey was undertaken for all existing assets on the North and West Shore. The full assessment, including asset descriptions and estimates of residual life are included in **Appendix A**.

2.4.1 North Shore

The current defences are a combination of soft and hard engineering methods with the majority being hard defences with the natural gravel upper beach, supplemented by artificial recharge, which provides protection to the stepped sea wall and promenade behind. Flood risk is mitigated by rear flood/dwarf walls at the rear of the promenade from the Cenotaph to Craig-Y-Don.

At the western end of the frontage, between the Pier and slipway at Trevor Street (aka Children’s Corner) there is a pocket of sand on the upper beach with some cobbles on the lower beach. To the east of Trevor St, the upper

beach comprises the recharged gravel beach fronting the stepped concrete revetment and promenade along the frontage.

Towards the east end of North Shore, at Craig-y-Don, an amenity pool extends the shoreline seaward in a slight promontory which is protected by a steeply sloping masonry wall. A cross shore concrete crib groyne constructed at the eastern end of the amenity pool frontage provides a degree of control on the movement of the upper beach material across the frontage, although some by-passing of material can occur.

Adjacent to the paddling pool is a new lifeboat station that is protected by a concrete wave return wall which is fronted by a rock revetment. To the east a natural upper shingle beach provides the coastal defence function with locally some private coastal defences in front of shoreline properties at the eastern end of the bay (Craigside).

2.4.2 Condition of North Shore Defences

Photo 1 and **Photo 2** provide an indication of some of the structural issues noted as part of the visual asset inspection which took place to support the development of the Llandudno OBC, The full inspection report can be found in **Appendix A** however overall the condition of the visible elements of the coastal defence structures inspected are in reasonably fair condition, evidenced by being the most frequently applied rate of "3-fair-green" followed by "2-good-blue". There were three elements identified as "4-poor-orange", with two of these identified as at potential risk of failure, *Central stretch of the Paddling Pool masonry wall-The Parade* and the *Stone wall, South parade - North sandy beach-Childs corner*.

Photo 1 shows missing mortar between some of the masonry blocks within the wall and two significant horizontal cracks. A potential cause could be progressive settlement due to scour. **Photo 2** shows some abrasion to the revetment, the steps also show some cracks in places which appear to be due to minor settlement.

Photo 1: Cracking in Wall to Paddling Pool

Photo 2: Moderately abrasion to concrete surface revetment

2.4.3 West Shore

To the north of the West Shore there is a vertical masonry wall that is fronted by a rock revetment, which protects the tolled highway that goes around the Great Orme.

The first fishtail rock groyne (Gogarth) is located adjacent to this and has a build-up of sand on the northern side, which has spread to the crest of the structure at its root, forming a natural dune feature.

From the Gogarth groyne to the Dale Road car park the frontage consists of a stepped concrete revetment. There is a small promenade at the top of the revetment which is backed with a wave return wall. Access over the wall is provided by steps over the top and at either end of the wall. Towards the car park end is the second, smallest, fishtail rock groyne (Lloyd Street) and again similar to Gogarth there is a build-up of sand and dune development at the root.

The stepped revetment, promenade and wave wall are showing signs of deterioration with abrasion of steps, cracks, spalls, and reinforcement bursting.

The car park abuts the beach with no formal defences in front of it, protection is provided by the natural upper shingle beach. The beach on the south side of the Lloyd Street groyne and across this frontage has been artificially

recharged with natural gravel shingle. South of the car park there is a Dwr Cymru pumping station, set back from the shoreline.

To the south there are sand dunes fronting the golf club. The upper beach across this frontage has been recharged in the past with quarried cobble to reduce erosion but the upper parts of the cobble have been gradually covered by sand. Part way along the dune frontage is the third fishtail groyne (Cerrig Duon). A combination of the groyne and the cobble protection to the north have increased sand levels across the lower beach with some sand blown onshore by the prevailing winds, aiding the development and expansion of the frontal dunes across this frontage.

National Cycle Route 5 runs along the West Shore to Deganwy along the crest of the artificial defences at the north end, along the top of the shingle bank in front of the car park and then along the toe of the dunes towards Cerrig Duon. South of Cerrig Duon the path continues along the toe of the dunes, initially along the crest of a small rock revetment and then along a timber revetment structure, the beach in front has been artificially recharged with quarried cobble.

From the car park, the cycle path is an unbound surface and across the dunes north of Cerrig Duon, the build-up of sand arising from the coastal protection works and the subsequent increase in windblown sand have produced new foredune formations that swamp the path in places, periodically. Sand fences have been installed to try and control sand movement but clearance and maintaining the path remains an on-going maintenance issue.

2.4.4 Condition of West Shore Defences

Photo 3 and **4** show two sections of the West Shore defences. Full details of the existing flood defences current condition are provided in the condition assessment reports for the North and West Shore in **Appendix A**.

The majority of assets reviewed are in good to fair condition, having the most frequent rate “3-fair-green”. However, there are some assets that have been scored as “4-poor-orange” and “5-very poor-red”. There are some concerning on-going issues have appear to be affecting the visible parts of the stepped revetment and return wall including large cracks and spalling, and re-bar corrosion stains on the revetment and return wall. Fencing on the sand dunes is failing at significant lengths and A proportion of embankment on the landward side of the cycle path adjacent to the Cerrig Duon Groyne (MUW5) which could pose a safety risk to the public. An “in depth” intrusive assessment of the condition several structures is recommended.

Photo 3 shows the concrete wave return wall which is approximately 750mm high between the north limit of the car park towards the central groyne with a concrete promenade immediately seaward, behind a concrete stepped revetment. The wave return wall surface is abraded and worn in places. It is recommended that further structural investigation and an appropriate repair plan put in place as part of the preferred option. The sand dunes (shown in **Photo 4**) have a good coverage of marram grass. The areas where the grass is sparse correlate to those areas suffering most from windblown sand accumulation on the cycle path. A combination of planting and fencing may maintain or further enhance protection and support of the dune system.

Photo 3: Promenade looking north from the Car Park

Photo 4: Sand Dune System and Cycleway

The condition assessments show that some repair of the existing defences is required and this will be considered as part of all short listed Do Something and Business as Usual options to ensure that the existing defences continue to provide protection to the community of Llandudno.

2.5 Relevant National and Regional Strategies and Plans

Section 2.5 summarises national and local legislation that is relevant to the development of the Llandudno OBC.

2.5.1.1 Welsh Government National FCERM Strategy

The Welsh Government National Strategy on Flood and Coastal Erosion Risk Management (2020) states that there are over 245,000 properties at risk from sea flooding, river flooding (main rivers and ordinary watercourses) and surface water flooding. The number of properties at risk is expected to increase as the climate changes with more frequent and severe floods, rising sea levels and faster rates of erosion of the coast which will mean more communities will be affected by flooding and coastal erosion, including some that are not currently considered to be at risk. The Strategy identified five key objectives for managing flood and coastal erosion risk in Wales:

- Improving our understanding and communication of risk;
- Preparedness and building resilience;
- Prioritising investment in the most at risk communities;
- Preventing more people being exposed to risk; and
- Providing an effective and sustained response to flood and coastal erosion events.

The Welsh Government (2016 – 2021) have stated that £256 million is to be invested in flood and coastal erosion risk management. In determining the priority of investment, the risk to life will always be the most significant factor.

2.5.1.2 Welsh Government Strategy

This project has been identified as a candidate for further consideration as part of the Welsh Government's Coastal Risk Management Programme (CRMP). Plans for the CRMP were announced by the Welsh Government in 2014 and are based around the use of long term borrowing and low interest rates by Welsh Government to support a programme of capital investment in coastal risk management infrastructure. Key details of the programme are:

- £150 million capital value investment;
- Co-funded between Welsh Government and local authorities with Welsh Government contributing 85% of capital costs of construction;
- Construction scheduled 2018-2021;
- Focussed on managing coastal flood and erosion risk to properties people and infrastructure;
- Enabling adaptation to climate change and implementation of SMP2 recommendations;
- Achieving wider additional and community benefits alongside reduced flood and erosion risk; and
- Contributing across the breadth of Welsh Government Well-Being Objectives but with particular emphasis on Objectives 6,7 and 8, looking for wider benefits also in support of the other objectives:
  - Objective 6. Support the change to a low carbon and climate resilient economy;
  - Objective 7. Connect communities through sustainable and resilient infrastructure; and
  - Objective 8. Support safe, cohesive, and resilient communities.

The CRMP Objectives are:

- By 31 March 2021: to have accelerated the delivery of Welsh Government National Strategy for Flooding and Coastal Erosion Management from an average annual capital spend of £19 million per annum 2010-2015 to an average annual spend of £50 million capital over the three years 2018-2021;
- By 31 March 2021: to have reduced risks to people, properties, and the economy, and in doing so, achieved at least 15,000 properties benefitting from:

  - extended or enhanced levels of protection from coastal flooding and erosion where assets are already in place; or new protection where new assets are built; and
  - demonstrating potential damages avoided of £450 million over the lifetime of the assets created or improved.
- To build wider benefits into project design and construction. Before each project proceeds to construction, each to have proportionately considered the potential for wider benefits including consideration of Welsh Government's Community Benefits policy and the Wellbeing of Future Generations Act.

2.5.1.3 Shoreline Management Plan (SMP)

The basis for strategic management of the Llandudno frontages is laid down in the SMP policies defined for the frontages. The Great Orme is the boundary between two different SMPs – the North West and North Wales SMP[4][5], which covers the North Wales coast to the east of the Great Orme, and the West of Wales SMP which covers the coast to the west of the Orme, including Anglesey.

For the North Shore, the current management policy is hold the line for the next 100 years.

The current management policy adopted for the West Shore is hold the line in the short to medium term (up to 2060) and managed realignment thereafter. The document states that there is significant economic value in maintaining and improving defences along the frontage. It also notes that the North Shore approach of hold the line would be redundant if the West Shore were to follow a different management approach. This is due to the topographic nature of the 'bowl', meaning if the western shore defence frontage were to fail or deteriorate, areas to the North would risk inundation from the west. The managed realignment policy for the future is proposed in order to implement a community-based adaptation looking at moving the current line of defence landward to create a more natural beach frontage.

The current policies of hold the line for both shores are achieved for present day conditions through the Council's current maintenance and beach management programme. Further assessment is required and has been undertaken as part of this OBC to assess the level of risk associated with the impact of climate change.

2.5.2 Conwy Tidal Flood Risk Assessment (CTFRA, 2006 and 2016)

In 2004, CCBC commissioned the production of a County wide assessment of flood risk, to inform future shoreline management and development planning. The original CTFRA was developed to assess the flood risk from wave overtopping and breach scenarios considering climate change impacts on water levels and waves[6].

As part of the Welsh Governments CRMP programme 2016-21, CCBC obtained funds to update the CTFRA to account for changes in climate change guidance, advances in the quality of available wave and water level data and new terrain data (LiDAR) to describe the land elevations were also incorporated. The updated CTFRA for the Llandudno area was produced by AECOM in 2017[7] and considered the risk of flooding from both still water levels, wave overtopping and breaches in the defences.

2.5.3 Beach Management Plan (BMP, 2017)

Further to the winter storms of 2013-14 and the subsequent emergency works to maintain beach levels at North Shore, CCBC commissioned AECOM in 2017[8] to produce an overarching BMP for Llandudno with the following objectives:

- Identify stakeholders and their desired requirements for the management of the beaches;
- Explain constraints on the selection of a management solution; and

[4] Halcrow (2011) North West and North Wales Coastal Group, North West England and North Wales Shoreline Management Plan SMP2

[6] Wallingford (2008) Conwy Tidal Flood Risk Assessment. Stage 1 – Final Report [online] Available from http://conwyfloodmap.hrwallingford.co.uk/report/HRWallingford_ConwyFRA_Stage1_Report_EX4667.pdf. Accessed 18/12/2019

[7] AECOM (2016) Conwy Tidal Flood Risk Assessment

[8] AECOM (2017) Llandudno Beach Management Plan.

- Assess potential beach management solutions against a range of criteria.

For the purposes of examining behaviour and considering appropriate management arrangements for Llandudno, the BMP set out specific Management Units (MUNs) for the North and West Shores. The location of the MUNs and cross-sections are shown in **Figure 2-5** and summarised in **Table 2-4.**

Table 2-4 Management Units

Management Unit
MUN1: Point of Headland to the Pier Wall
MUN2: Children's Corner from the Pier Wall to Trevor Street slipway
MUN3: Trevor Street slipway to Tudor Road
MUN4: Tudor Road to the Craig-y-Don paddling pool
MUN5: Craig-y-Don paddling pool
MUN6: Craig-y-Don paddling pool to the start of the fishing zone at Craigside
MUW1: Frontage along Marine Drive to Gogarth Breakwater
MUW2: Gogarth Breakwater to Lloyd Street Breakwater
MUW3: Lloyd Street Breakwater to Dale Road car park
MUW4: Dale Road car park to Cerrig Duon Breakwater
MUW5: Immediately south of Cerrig Duon Breakwater

The BMP identified a range of future management options that could be considered to address the specific shoreline management and associated amenity issues associated with the two frontages and proposed a series of potential options to be developed within a CRMP framework. These options have been considered in the development of the long list of options supporting the Llandudno OBC.

2.5.4 Tourism Strategy (2019)

Llandudno is known as the Queen of the Welsh Resorts and is established as a premier Welsh and UK-wide seaside destination. Its easy accessibility to people, particularly in the Northwest of England and Wales. Llandudno allows visitors the ability to visit a traditional seaside whilst also offering a major retail centre, accommodation and food and drink establishments all within close proximity of each other. To assist with supporting the overall development strategy and provide an overview of the likely development for the town, the Council commissioned an assessment for the long-term tourism strategy and to provide an understanding economic impact of this tourism on the local economy.

Tourism in Llandudno has grown in both day visitors and overnight stays which translates to growth in the local economy including employment. Today, Llandudno faces very different challenges due to the increasingly competitive market both domestically and internationally. It's therefore vital the town adapts to these challenges and continues to adapt and innovate to remain a prime tourism location for people in the UK and beyond. This will mean identifying the emerging trends facing the tourism sector and being proactive to plan for changes. Other challenges include embracing the fundamental role of technology both in destination choice and in the tourism product, lower levels of visitor loyalty, demographic, societal and economic changes, and lifestyle factors such as increasing levels of flexible working.

Should Llandudno continue to adapt to the changing conditions within the tourism market and invest accordingly, the high growth scenario under this analysis suggests that:

- The number of day visitors is set to increase from 2.88 million in 2018 to 4.08 million in 2045;
- The number of overnight trips taken to Llandudno is set to rise from 440,289 in 2018 to 561,339 by 2045; and
- The economic impact of tourism in Llandudno is expected to rise from £388.8 million in 2018 to £513.6 million in 2045.

This will require the continuation of the concerted and co-ordinated effort across Welsh Government, local government, industry bodies, the private sector and residents which has stimulated growth and championed development. The continual growth of the local economy reinforces the need for ensuring that the coastal defences are maintained and are adapted/improved to deal with climate change and the increase of visitor numbers to the area including the diversifying demographic.

See **Appendix B** for the full Tourism Strategy for Llandudno.

2.5.5 Local Plan and Development Policies

Conwy Local Development Plan (CLDP, 2013) was produced by CCBC and sets out the Council's priorities for development of land within the Borough and policies for implementation over the period 2007 – 2022. The LDP was adopted in 2013 and has been subsequently monitored. A full review of the LDP was undertaken in 2017 and is at Stage 5 of the process, production of a preferred strategy document. This document identifies issues and objectives, preferred level of growth and preferred spatial strategy. It identifies five Strategic Sites and 34 Strategic Policies. A replacement plan is currently being developed (2018 – 2033) and was consulted on between June – September 2019.

Within the Creuddyn Strategic Area, Llandudno Town Centre and Llandudno Junction are identified as sites marked for growth and improvement. This area will contain 30% of projected housing growth and 30% of the job growth for the area and include protection of Llandudno town centre and regeneration of the junction area as an economic hub.

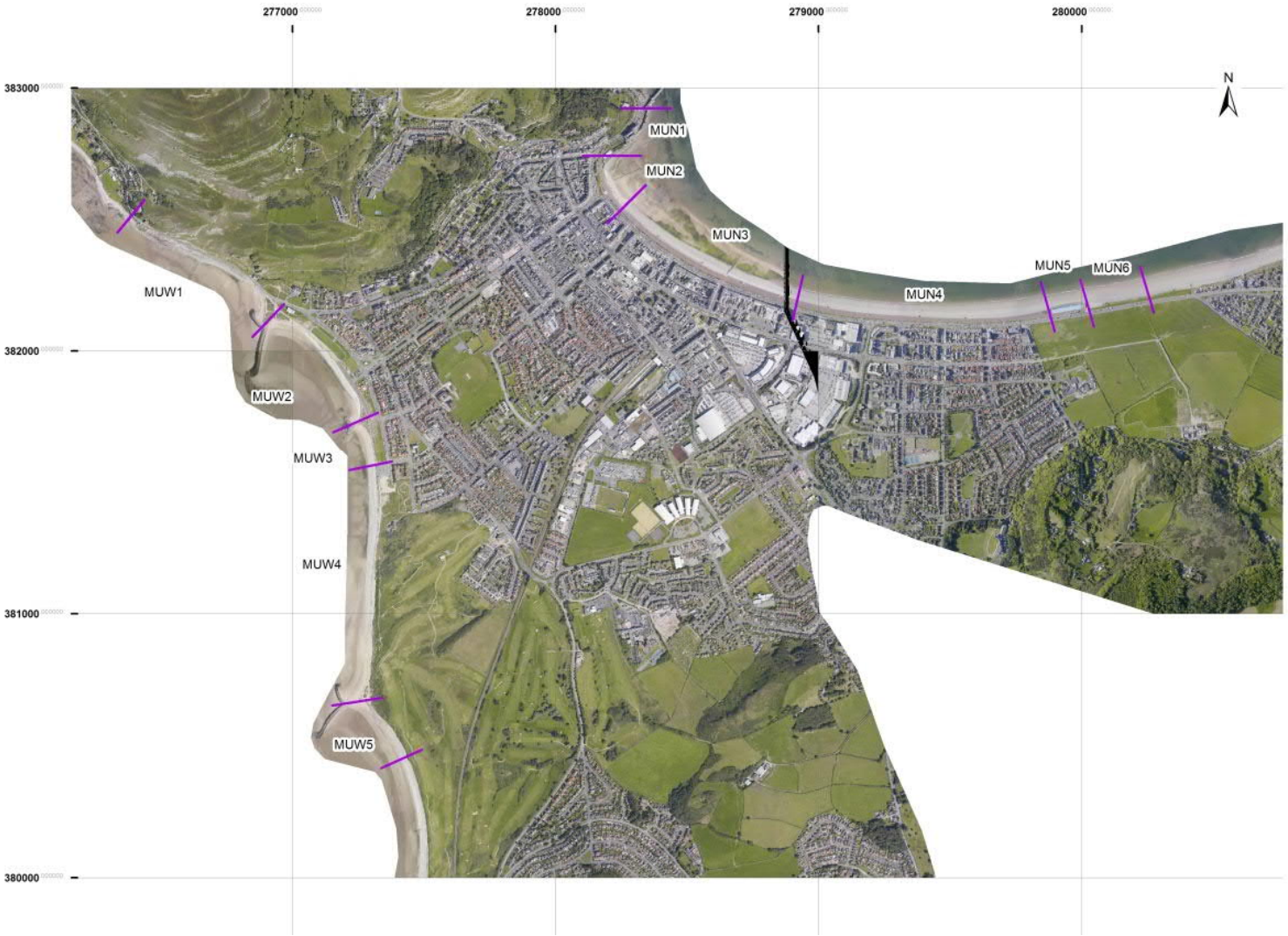

Figure 2-5. Locations of the Management Units taken from the BMP

2.5.6 Sustainability and Well-Being

The Well-Being of Future Generations Act (WBFGA) was introduced in 2015 to ensure Welsh public policy and spending is sustainable and safeguards the interests of today's and future generations. The WBFGA features a series of overarching Well Being Goals, which are:

- A globally responsible Wales;
- A prosperous Wales;
- A resilient Wales;
- A healthier Wales;
- A more equal Wales;
- A Wales of cohesive communities; and
- A Wales of vibrant culture and thriving Welsh Language.

The Llandudno OBC objectives aim to align with the WBFGA, with parallels to both the goals and 'ways of working'. The project aims to contribute to achieving all the WBFGA objectives either through first order benefits or from spill over and wider benefits. Key examples of where this will be achieved include:

- "Long-term prevention / Prosperous, Resilient & Globally Responsible" – A scheme which manages the effects of flood risk and coastal erosion will ensure residential & commercial properties and critical infrastructure will be protected from the risk of erosion and flooding, whilst being made more resilient to climate change;
- "Collaboration & Involvement / Healthier, Cohesive Communities, Thriving Culture & Heritage" – Preserving Llandudno's popular beaches will allow it to benefit from efforts to grow out-of-season tourism throughout Conwy. It will allow it to continue serving the local community as a popular area for regular outdoor exercise helping the older residents of Llandudno in particular, with access to a local beach and its associated health and wellbeing benefits. Generally, Llandudno is seen to provide a valued amenity to the local community and is considered a key asset to the area; and
- "Strengthening and regenerating communities / More equal" – Without appropriate shoreline management measures the vibrant existing community will be threatened by increasing flood risk.

2.5.6.1 State of Natural Resources Report

The State of Natural Resources Report (SoNaRR) 2016 highlights how ecosystems and natural resources contribute to all the well-being goals set out in the WBFGA. The report references the positive impacts the enhancement of natural coastal margins can have on combating climate change and the resilience they offer to coastal flooding.

2.5.7 Local Well-Being Plans

Conwy and Denbighshire have combined to develop one Local Well-Being Plan that covers both counties. They have focussed on 3 priorities they believe cover the 7 well-being goals in the WBFGA. These 3 priorities are people, communities, and place.

In the medium term they have set out a target of maximising the use of the environment to encourage positive mental well-being and to have communities that are better prepared for weather extremes.

2.5.8 Other Local Policies

CCBC Environmental Policy has resulted in the Council receiving Level 5 accreditation under the Green Dragon scheme, since 2014. Level 5 accreditation confirms they show continual environmental improvement. For the Council to maintain accreditation and stay in line with their environmental objectives the preferred options will consider the environment and long-term sustainability.

2.6 Investment objectives

The Welsh Government has set out a programme of support with the objective of improving coastal communities' resilience to climate change. This is set out in the 'Coastal Risk Management Programme – Guidance Notes for Local Authorities' (Welsh Government, 2015). This programme provides a one-off opportunity for Local Authorities

to implement transformational projects for coastal communities, with the Welsh Government contributing 85% of the construction costs (Welsh Government, 2020). The objectives of the programme are as follows:

- Accelerate the delivery of Welsh Government's National Strategy for Flooding and Coastal Erosion Management in Wales. In doing so, reducing risks to people, properties, and the economy[9];
- Encourage innovative solutions which deliver multiple benefits (e.g. tourism, regeneration, transport, and environment as well as flood resilience); and
- Deliver social benefits by raising awareness and increasing community resilience.

In order to be eligible for capital funding, projects will need to clearly set out their capital expenditure profile. Projects are expected to demonstrate how they can achieve 'wider benefits' which includes local benefits e.g. through employment or skills training as part of the construction process. Also, through achieving goals set out in the WBFGA.

The investment objectives for this project are:

- To manage and/or reduce the impact of flooding to people, property, and commercial premises. The main element will be to reduce flooding to residential areas where lives may be at risk;
    - To manage the risk of coastal erosion by maintaining adequate beaches and defence measures;
    - To ensure future climate change adaptability;
    - To align with National FCERM Strategy objectives and Shoreline Management Plan Policies;
    - To demonstrate value for money by having a positive Net Present Value (NPV);
    - Measures to be achievable within current or anticipated Welsh Government and Local Authority funding settlements and borrowing powers;
    - The new defences should be considerate to the local environment and where possible increase biodiversity within the area; and
    - Measures to align with local Well-being plans.

From these investment objectives, frontage management objectives were developed as part of Stakeholder Engagement with the Llandudno Coastal Forum (LCF). These are to be used to support the findings of the appraisal. These objective of the LCF is to develop a sustainable beach management strategy for Llandudno which seeks to:

- Delivery of flood and coastal erosion risk management objectives;
- Provide beaches that are fit for purpose;
- Improve the natural environment, recreational space, and aesthetics; and
- Create opportunities for commercial activities within the town.

2.7 Environmental and Other Considerations

An Environmental Note has been completed to support the development of the OBC, which can be located in **Appendix C**. A summary of the key points is provided below. The environmental assessment provides an understanding of the key constraints if a scheme was to be constructed in Llandudno and any restrictions on programme and consents required. A key constraints plan can be found in **Appendix C.**

2.7.1 North Shore Key Constraints

The waters at North Shore are designated bathing waters and the area is listed as medium sensitivity under the Water Framework Directive (WFD). The Great Orme, west of the pier, is classified as a Site of Special Scientific Interest (SSSI). The environmental assessment carried as part of the Beach Management Plan (AECOM, 2017) and the Environmental Note found that there could be the potential for disruption to local habitats due to construction works undertaken within or adjacent to the Menai Strait and Conwy Bay Special Area of Conservation

[9] The figures in brackets will be informed by individual project business cases.

(SAC) and Liverpool Bay Special Protection Area (SPA). There are also several local SSSIs located near the North Shore.

2.7.2 West Shore Key Constraints

The Beach Management Plan (AECOM, 2017) and Environmental Appraisal Report (**Appendix C****Error! Reference source not found.**) found the following environmental constraints close to or within the West Shore area. The West Shore is designated as an SSSI and to the north at the Great Orme is a local nature reserve. Due to the location of habitats within the designated sites there are likely to be seasonal constraints on any works e.g. breeding birds. The Shore is also adjacent to the Menai Strait and Conwy Bay SAC and Liverpool Bay SPA. The sand dunes are covered under the UK Biodiversity Action Plan (BAP); this may be affected if the system is changed to prevent sand build up. There are also a number of local SSSIs and NNRs located in close proximity to the West Shore.

2.8 Potential Opportunities and Benefits of Investment

The main benefits expected from further investment in the defences in Llandudno are as follows:

- Maintaining protection to existing hard coastal defence assets, extending their useful life;
- Reducing the risk of flooding from the combination of wave overtopping and an increase in the mean sea level, expected from sea level rise in the next 100 years;
- Reducing and managing the impacts of windblown sand along West Shore to infrastructure, property, and the cycle path;
- Potential for providing improved amenity and potential for tourism development; and
- Managing risk of damage to local and national heritage interests, such as listed buildings.

2.9 Potential Risks, Constraints and Dependencies

2.9.1 Risks

A risk register has been included as **Appendix D**. The following strategic risks associated with the project have been identified:

- The ability of the Council to provide a proportion of match funding to progress to FBC and Scheme Design & Construction;
- The acceptability of the project to local residents. The local community are keen to see a scheme progressed for Llandudno but have specific views about what this should entail. Drawing on the outcome from the OBC, a detailed community wide consultation event will be required during detailed design with appropriate visualisation material to help communicate the optioneering process and manage this risk;
- The project preferred by the local community may not demonstrate value for money and meet rules for capital investment in defences in accordance with current CRMP arrangements;
- Refusal of Planning Permission and other approvals e.g. Marine License;
- Lack of future funding potentially does not realise the full benefits over the project lifetime;
- Inadequate redundancy measures to mitigate against the flood risks in the event of system failure e.g. ability of local land drainage system to cope with flooding due to local topography; and
- Major flood / asset failure before scheme completion may alter public perceptions of risk.

Specific risks associated with the likely form of coastal defence measures are:

- Potential for higher future beach management costs than originally anticipated;
- Failure of Local Authority to fund/carry out appropriate future beach management measures - reprofiling/recycling/topping up etc;
- Increased capital costs due to inadequate information at design stage e.g. Ground Investigations;
- Public/ political opposition to preferred option; and

- Environmental Designations including SAC and SSSI may cause issues during construction.

2.9.2 Constraints

Possible constraints regarding the delivery of a scheme in Llandudno have been identified at a national and a local level as well as noted dependencies:

2.9.2.1 Welsh Government

- Welsh Government construction finance not available;
- Welsh Government project contribution for detailed design may not be available; and
- Not achievable in Welsh Government CRMP construction timeframe.

2.9.2.2 Local

- Availability/lack of CCBC contribution to on-going project costs;
- Availability of third party contributions, other grants e.g. EU funding etc.;
- Preferred option may not align with the general public's vision;
- Availability of future funding to maintain and manage the project; and
- Permitted development rights may be accepted due to the presence of existing defences but it is likely that planning permission will be required.

2.9.3 Dependencies

- The project is dependent on Welsh Government approval for further funding;
- The project is dependent on the Council and potentially other third parties finding match funding;
- On-going flood and coastal erosion risk being effectively managed by CCBC and others;
- Incorporation of any environmental mitigation, as required; and
- Consents required for any works to utilities and highways.

2.10 Stakeholder Engagement

A series of consultation exercises have been undertaken with the local people of Llandudno and the Local Coastal Forum (LCF). The LCF has been engaged with throughout the development of current and future coastal management arrangements following "topping up" of the existing beach nourishment after the storms in 2013/14, which caused significant amount of adverse comments, particularly on social media and the local newspapers. Following a public meeting in 2016, CCBC proceeded with development of a BMP for the Llandudno frontages (North and West Shore). Public consultation through an engagement event on the outcomes of the BMP was carried out in November 2017. Subsequently, CCBC commissioned the development of an OBC (this study) which would further develop the proposed options into feasible solutions.

Over the course of the development of the Outline Business Case, LCF have highlighted their concerns with a number of issues.

- The requirements to maintain any cultural heritage or historic features and/or archaeological assets along the North Shore;
- Requirements to install an amenity/sand beach at North Shore which would provide an attraction for local people and visitors;
- Adjustments/improvements to children corner at North Shore; and
- Address the windblown sand issue at West Shore.

The key issue which the LCF and member of the public have made clear is there preference for a sand beach along the North Shore, or at least an extended beach.

During the development of the preferred options, CCBC organised a two-day event on the 26th & 27th July 2019. Over 773 individuals signed in with many more in attendance. At this event, there was an opportunity to discuss

the options/proposals and provide feedback with 143 written comments received (see **Appendix M**) for full details of comments). The feedback was varied in its nature, but the following provides an overview of the general themes which are important to the community of Llandudno:

- Removal of the stones from the beach;
- Installation of a sand beach to assist with rock;
- Installation of groynes (timber);
- A beach to attract tourists/tourism; and
- Accessibility (disabled or otherwise).

As part of the consultation exercise, the LCF provided additional comments and independent information which relate to the tourism within Llandudno, particularly around the Llandudno Pier (**Appendix M, LCF, Llandudno Pier**). Also, further statements have been provided in support of restoring the sand beach and the local archaeology along the local coastlines (**Appendix M, LCF, Restore Our Beach & Ships Timbers**).

Throughout the consultation exercises, there was overwhelming support for the installation of a sand beach supported by timber groynes. Some of the comments made links to the fact that this was the original arrangement historically and that any new proposals need to consider this as the optimal solution from a heritage and tourism perspective. The feedback from this event has been used to identify the short list of options considered within this OBC. Subsequently, the proposed Llandudno Coastal Defence Improvement scheme was raised at the CCBC Cabinet[10] meeting (**Appendix N, Cabinet Meeting Minutes**) which took place on the 12th November 2019. It was agreed that the OBC should proceed and should take into account the feedback from the public consultation that took place in July 2019 and that the option which extends the beach at North Shore to Vaughan Street with the use of timber groynes. For the purposes of this OBC, this is the Alternative Option proposed. It was also noted that the heritage value of the town should be a key consideration when identify the preferred option for flood and coastal erosion risk management works in Llandudno.

In summary, there is strong support to provide an extended sand beach at North Shore, retain heritage features which in turn would support and increase the overall tourism value within Llandudno.

[10] https://conwy.public-i.tv/core/portal/webcast_interactive/451091

3. Economic Case

3.1 Critical Success Factors

The same set of Critical Success Factors (CSF) were used to appraise the options for the North and West Shore and have been summarised below in **Table 3-1.**

Table 3-1 Critical Success Factors

Category	Success Factor
Strategic Fit and Business Needs (strategic case)	Option is adaptable to climate change
	Option delivers Welsh Government National Strategy and Shoreline Management Plan objectives
	The option has Local Authority and key stakeholder support
	Option aligns with local well-being plans
Potential Value for Money	Commercial properties and economic assets and infrastructure are better protected
	Option is likely to have Positive Net Present Value
Potential Achievability	Local Authority has the capacity to produce and manage the project
Supplier Capacity and Capability	Supply has the capacity to deliver an affordable solution within the timeframe
Potential Affordability	Option is achievable within the current or anticipated Welsh Government and Local Authority funding settlements and borrowing powers

In addition to the CS F, Frontage Management Objectives were developed in collaboration with the Local Coastal Forum (LCF). As discussed in the Strategic Case, this group was formed to ensure the local community has a voice in the future development and management of the beaches in Llandudno. These agreed objectives are:

- The option delivers flood and coastal erosion risk management objectives;
- The option helps to provide beaches that are fit for purpose;
- Improve the natural environment, recreational space, and aesthetics; and
- Create opportunities for commercial activities within the town

The option appraisal has considered both the CSF and the Frontage Management Objectives to determine the Preferred Option for flood risk management in Llandudno.

3.2 Approach to Option Appraisal

The approach to options assessment is aligned with the FCERM Business Case Guidance issued by the Welsh Government[11]. A long list of options was identified as part of the Strategic Outline Case (SOC) and then screened to form a short list of options. At OBC the short list has been screened to identify the Preferred Option.

The SOC was undertaken as part of the Conwy Tidal Flood Risk Assessment and BMP. As part of the OBC the measures identified have been appraised using the Critical Success Factors and the Frontage Management Objectives developed between the Council and the LCF to develop a preferred Option.

3.3 Identify Long List

The work previously completed for the BMP identified a long list of options for both the North Shore and West Shore. The study area was separated into MUNs and **Figure 2-5**), these MUNs are referred to in the description

[11] Flood and Coastal Erosion Risk Management – Business Case Guidance, Welsh Government 2018

of some long listed options. The long list of options are summarised in Table 3-2 and Table 3-3. The options were presented to the public in November 2016 and feedback was considered in the identification of the short list.

3.3.1 North Shore

Table 3-2. Long-List of Measures for the North Shore

Option	Description
Walkaway	Walkaway would allow the defences to deteriorate with no further maintenance undertaken. This scenario has been considered as a baseline in accordance with the WG appraisal guidance.
Business as Usual	Business as Usual would mean undertaking the minimum maintenance required to maintain the health and safety standards for people to be able to access the beach and to maintain the current standard of protection to people and property.
Option 1: Detached breakwaters and groynes	Option 1a: surface piercing or emergent breakwaters Option 1b: submerged breakwaters Both are in combination with rock groynes, the removal of some of the existing shingle and replacement with sand.
Option 2: Fishtail rock groynes	Option 2a: fishtail groynes Option 2b: larger fishtail groynes/breakwaters Both options include additional rock groynes, the removal of some of the existing shingle and replacement with sand.
Option 3: Traditional timber groynes	Removal of the shingle and cobbles from MUN3, re-nourishing with sand and installing a number of timber groynes, possibly with a breakwater to protect MUN1.
Option 4: Beach nourishment	Option 4a: A single capital re-nourishment of the beach with sand of sufficient quantity to last 20 years. Option 4b: An initial capital re-nourishment and periodic maintenance recharge of the sand. Existing shingle will be removed from the upper beach and sand will be placed on the beach. No control structures are proposed along the frontage.
Option 5: Beach nourishment at Children's Corner	Shingle in MUN2 will be removed and sand will be placed on the beach with maintenance required periodically. No additional control structures are proposed along the frontage.
Option 6: Wave return wall for Paddling Pool	A wave return wall will be added to the crest of the paddling pool revetment
Option 7: Wave return wall along the promenade	A wave return wall would be constructed along the promenade to increase the standard of protection.

3.3.2 West Shore

Table 3-3. Long List of Measures for the West Shore

Option	Description
Walkaway	Walkaway would allow the defences to deteriorate with no further maintenance undertaken. This scenario has been considered as a baseline in accordance with the WG appraisal guidance.
Business as usual	Business as usual would mean undertaking the minimum maintenance required to maintain the health and safety standards for people to be able to access the beach and to maintain the current standard of protection to people and property.
Option 1: Periodic beach maintenance	This option assumes that the back of the beach is recharged with shingle and there is ongoing maintenance of the sand on the beach. Excess material will be removed regularly from the frontage and re-used in other areas (possibly North Shore) where required.
Option 2: Dune regeneration	Forming dunes at a number of locations with sand filled geotextile bags at their core. These will continue to accumulate material and grow over time, creating a barrier to windblown material. New plants will also be planted on the dunes to encourage growth of the dune.
Option 3: New concrete wall and periodic beach maintenance	A concrete wall will be constructed along the back of the beach in order to prevent windblown sand. This will be backed by a retaining wall to prevent material loss.
Option 4: Rock cover layer	A cover layer of 5-10kg rock will be placed over the existing beach material in order to prevent windblown sand. This will be backed by a retaining wall to prevent material loss.

Option	Description
Option 5: Sand traps	Installation of a series of sand traps along the frontage to assist in trapping more of the windblown sand that impacts the frontage.
Option 6: Breakwater removal	This option involves the removal of the three existing breakwaters which are located along the West Shore; the Gogarth Breakwater, Lloyd Street Breakwater and Cerrig Duon Breakwater. The beach will be re-instated to a 'natural' state.
Option 7: Raised/Realigned walkway	This provides for the provision of a raised pedestrian/cycle route along the toe or the crest of the dunes across the southern half of the frontage.
Option 8: Wall repairs/raising	It is proposed to undertake local repairs to the existing wall structure where it is currently in a state of disrepair. Where required, the existing wall will be raised to improve the frontage defence standard.
Option 9: Combined scheme	Combination of Options 1, 3, 4 or 5, 7 and 8.

3.4 Screen the Performance of Each Measure

The measures identified for both shorelines were appraised using the CSF and Frontage Management Objectives developed with LCF. The results of this process can be found in **Appendix F**.

It should be noted that at West Shore a number of the options identified as part of the development of the BMP (specifically Options 4, 5 and 7) are elements of an overall shoreline management approach that improve the amenity use of the beach and local well-being by reducing the impacts of windblown sand, whilst providing better access arrangements. They do not primarily provide a flood or coastal erosion risk management function. Therefore, at this stage, the rock cover layer (Option 4), sand traps (Option 5) and raised walkway (Option 7) are not considered as independent measures but in combination with other shortlisted measures.

The solution identified as part of this OBC should primarily protect against the risk of flooding, but aligned with objectives set out by the Welsh Government and through feedback with the community, the solution should also look to improve the wellbeing and protect and support tourism to the area.

3.5 Identify the Short List

The short list of options was identified through review of technical information available, feedback from stakeholders and assessment of information received through the appraisal of the Outline Business Case including the conclusions of the Tourism Study (**Appendix B**), Geotechnical and Geo-environmental Desk Study (**Appendix G**), Hydraulic Modelling (**Appendix H**) and Environmental Appraisal Report. (**Appendix C**).

3.5.1 North Shore

Based on the economic assessment and supported by previous assessments there is no requirement to provide an improved level of defence along the rear edge of the promenade in the present day for the North Shore, Although investment will be required in the future to protect against climate change. Some investment will also be required to repair the existing defences to ensure they continue to provide protection.

Assessment against the Critical Success Factors and Frontage Management Objectives has shortlisted the options in **Table 3-4.**

Table 3-4 North Shore Short Listed Options

Reference	Scenario	Description
Walk Away	Walk Away	Required in accordance with WG business case guidance. All maintenance and beach monitoring would cease. Over time the defences would begin to fail, and the beach levels would drop causing an increase in overtopping and in the long term flooding from still water levels.
Business As Usual	Business as usual	Required in accordance with WG business case guidance. This would maintain the present sand beach at Children's Corner and the

Reference	Scenario	Description
		cobble beach between the Trevor Street slipway and the paddling pool. Ad hoc repairs to the existing defences would be required as part of this option.
Do Something 1	Beach nourishment with shore connected structures such as fishtail or timber groynes.	At the western end, part of the cobble beach would be replaced with sand; further work would be required to determine the optimum arrangements. The form of control structure would be dependent on the beach arrangements. It has been assumed, for the purposes of this assessment, that timber groynes would be installed. Rock groynes were considered at Do Something 1a and timber groynes were considered as Do Something 1b. Do Something 1b has been taken forward for assessment as was considered to be a more robust and reliable option from an engineering perspective. Although the replacement of shingle with sand is more costly, the option remains viable and beach nourishment is preferable to local stakeholders and provides a wider tourism benefits to the local economy. With rising sea levels, the rear wall will need to be raised in order to minimise the risk of flooding from overtopping. Ad hoc repairs to the existing defences would be required as part of this option.
Do Something 2	Beach nourishment alone	Part of the cobbled beach would be replaced with sand to the western end of the frontage. However, with no control structure in place, ongoing beach maintenance could become a liability e.g. increased frequency of beach recycling and/or topping up. Although the replacement of shingle with sand is more costly, the option remains viable and beach nourishment is preferable to local stakeholders and provides a wider tourism benefits to the local economy. With rising sea levels, the rear wall will need to be raised in order to minimise the risk of flooding from overtopping. Ad hoc repairs to the existing defences would be required as part of this option.
Do Something 3	Business as usual with the raising of the rear promenade wall before year 50	If beach levels are maintained to their current standard, then the beach will act as the primary flood defence however with rising sea levels the rear wall will need to be raised in order to minimise the risk of flooding from overtopping. Ad hoc repairs to the existing defences would be required as part of this option.

3.5.2 West Shore

In the long term the Shoreline Management Plan (West of Wales SMP2) policy for West Shore changes from hold the line to managed realignment. This has resulted in a number of the measures developed in the BMP no longer being viable as the current plan is to maintain the defences for the next 50 years and then in the long term implement a community-based adaptation looking at moving the current line of defence landward to create a more natural beach frontage. It should be noted that defences on the West Shore will be required throughout the appraisal period to ensure protection to the community of Llandudno.

Similar to North Shore, provided beach volumes are maintained, there is limited requirement at West Shore to provide an improved level of flood defence during the present day scenario with the exception of the section between the present sea wall and the dunes where there are localised low points, without defences. This flood mechanism, in the present-day scenario, can be seen in the modelling outputs from the BMP. Consideration should therefore be given to extending the secondary defences across the back of the beach between the existing hard defences and the dunes in front of the North Wales Golf Club.

Consideration of available information has identified the measures summarised in **Table 3-5** to be taken forward to short list.

Table 3-5 West Shore Short Listed Options

Reference	Scenario	Description
Walkaway	Walkaway	Required in accordance with WG business case guidance. All maintenance and beach monitoring would cease. Over time the defences are likely to fail, increasing the rate of overtopping. Once the level of available defences has dropped flooding from still water levels will increase.
Business As Usual	Business as usual	Required in accordance with WG business case guidance. This would involve maintaining current beach conditions, routine maintenance of the existing seawall structure and local measures to trap, remove and recycle windblown sand. Ad hoc repairs to the existing defences would be required as part of this option.
Do Something 1	Periodic beach maintenance	Business as usual but to include topping up with additional shingle, as required. Ad hoc repairs to the existing defences would be required as part of this option. An allowance has been assumed for works undertaken in Year 50 and has been incorporated into the whole life cost breakdown in order to cover capital maintenance and refurbishment of existing assets. Further assessment is required to determine whether the option would support the managed realignment recommendation from the SMP or whether would require an update to the SMP policy by 2060.
Do Something 2	Wall extension	Business as usual plus the extension of secondary defences between the existing hard defences and the dunes in front of North Wales Golf Club. Ad hoc repairs to the existing defences would be required as part of this option. An allowance has been assumed for works undertaken in Year 50 and has been incorporated into the whole life cost breakdown in order to cover capital maintenance and refurbishment of existing and proposed assets. Further assessment is required to determine whether the option would support the managed realignment recommendation from the SMP or whether would require an update to the SMP policy by 2060.
Do Something 3	Combined scheme	Implementation of Do Something 1 and Do Something 2 including the following environmental improvements:

Reference	Scenario	Description
		• Provision of new windblown sand control measures such as sand traps or rock layer; and • Provision of a raised or realigned walkway along the southern half of the frontage.

3.6 Assessment of Short List

3.6.1 Engineering Performance

Assessment of the engineering performance of each option has been summarised in **Table 3-6.**

Table 3-6: Engineering Performance

Option	Engineering Performance
North Shore – Do Something 1 *Beach nourishment with shore connected structures such as fishtail or timber groynes*	The removal of any cobble and replenishment with sand, along the North Shore would likely take place at the western end of the frontage, where shelter is provided by the Great Orme. A sand beach would be designed to provide equivalent performance as the cobble beach but there is a finite level of protection that the beach can provide as its crest level can't exceed the level of the stepped revetment and the profile is constrained by the width of the inter-tidal zone. A beach from Children's Corner would extend to Vaughan Street would require control structures (groynes) to stabilise the beach in the short-medium term. We have undertaken our economic assessment assuming that the beach would be sufficiently controlled by 5 No. timber groynes, 200m long evenly spaced or 3 No. rock groynes 200m long along this section of the frontage. This would need to be confirmed with detailed numerical modelling in future stages of the design. Without the inclusion of control structures, it is likely that large volumes of sand will be carried offshore every year, incurring high ongoing maintenance costs as sand replenishment will be required. Timber and rock groynes were considered as part of this assessment, but timber was chosen to be taken forward due to feedback from stakeholder engagement and their wish to restore the historic feature. The considerations of the North Shore Do Something 2 also apply to this option, although as this option considers control structures it has been assumed that the volume of sand carried offshore would be reduced, but a larger capital construction cost would be incurred. Higher sand levels will give rise to a significant windblown sand problem that is likely to adversely impact on properties and infrastructure. This problem already occurs at the West Shore as shown by the dune developments at the groyne structures. With rising sea levels, the rear wall will need to be raised in order to minimise the risk of flooding from overtopping. Ad hoc repairs to the existing defences would be required as part of this option.
North Shore – Do Something 2 *Beach Nourishment Alone*	The replenishment of the existing sand and cobbles along the frontage would provide sufficient protection along the frontage for the present day. This option assumes that present day levels will be maintained over the lifespan of the defences. No control structures have been included as part of this option as the current situation as this upper beach remains reasonably stable. With rising sea levels, the rear wall will need to be raised in order to minimise the risk of flooding from overtopping. This would provide increased protection to account for future climate change. Ad hoc repairs to the existing defences would be required as part of this option.

North Shore – Do Something 3 *Business as usual with the raising of the rear promenade wall before year 50*	The present day flood risk is not significant therefore this option proposes works in the future rather than in Year 0 of the appraisal. Not being able to use the promenade during a flood or extreme wave scenario would continue. The rear wall would be designed to allow for the height to be raised, if required, however this will depend on the construction of the existing wall. There will be the capacity for additional structures to be constructed in front of the wall as well depending on what the flood risk requirements are for the frontage. If suitable, the wall could incorporate a planter to help minimise the aesthetic impact of a raised concrete wall along the frontage. Ad hoc repairs to the existing defences would be required as part of this option.
West Shore – Do Something 1 *Periodic beach maintenance*	This option will move sediment across the beach to allow for longshore and cross shore drift ensuring that the existing hard defences don't become comprised by scour at the toe. This option may also help to increase safety of the beach by reducing the sand bars that form, however they will continue to form between scheduled maintenance. There is the provision within this option to add additional shingle to the beach to aid in protecting the beach from wave action and wind. Shingle has been used on previous occasions to reduce the impacts of windblown sand on the cycle path at the rear of the beach. There is an allowance for works to be undertaken before Year 50 for a replacement wall to be installed to account for future climate change.
West Shore – Do Something 2 *Wall Extension*	This option will increase the flood protection across Dale Road car park and the properties behind it. The wall would extend approximately 300m south from the existing hard defences. It will also offer protection to the cycle path from windblown sand if the levels in front of the wall are maintained as part of a maintenance schedule.
West Shore – Do Something 3 *Combined Scheme*	This option would have the same benefits and concerns as Do Something 1 and 3. Although this option also looks to provide the additional benefit of a raised walkaway which will allow continued use of the cycle path and reduce the problems caused by windblown sand as well as allowing the sand to pass beneath the walkaway keeping a supply of sand to the existing dune system behind. The walkway is proposed to be approximately 1000mm off the ground which will provide a sufficient gap beneath the walkaway. Sand traps are also proposed which would help to develop natural sand dunes that would act as an additional natural flood defence in the future or help to protect the existing dunes from erosion. The sand traps are expected to be installed along most of the frontage.

3.6.2 Sustainability and Wellbeing Performance of the Short List

Both short lists have been assessed against the WG Well-Being of Future Generations Act and local well-being objectives as they formed part of the critical success factors used to appraise the long list. All the options have been discussed with the CCBC and LCF and their opinions considered when developing the short list.

The Business as Usual option is not considered appropriate for the West Shore or the North Shore, the impact of climate change is considered to be significant over the appraisal period and the increased flood risk is not considered acceptable to the community.

3.6.2.1 North Shore

North Shore Do Something 1 and 2 will increase the amenity use and therefore enhance to a greater degree the well-being of the local people as well achieve the objectives developed in conjunction with members of the

community. Without the inclusion of control structures, it would be difficult to maintain beach levels sufficiently to provide coastal protection.

In the medium term maintaining the beach levels are likely to incur significant costs. However, even with the structures in place loss of sediment is more likely to occur compared to the existing cobble due to the mobility of the material and in the long term similar significant costs to no structures option (Do Something 2) should be expected. These options, depending on the final groyne design, will also seek to continue to maintain the current cultural heritage aspects of the town whilst increasing its appeal as a tourist destination with a more accessible and user friendly beach.

Although, these options will provide increased amenity to the beaches which is a key focus of the local people, the long term defence capability is limited if sea levels rise as predicted. Maintaining the beach levels will offer protection however, with the increase in sea level, additional defences will need to be implemented to increase the height of the current revetment or rear promenade wall. Therefore, there is limited opportunity to adapt the proposed options to allow for climate change in the long term.

Do Something 3 for the North Shore will provide increased flood protection in the long term however, the lack of increased amenity use of the beach does not fully achieving the objectives set out by the LCF. During high water levels or extreme waves condition, the promenade and beach will be inaccessible, but the reduced flood risk will allow the public continued use of the road along the frontage and access to the businesses and homes.

3.6.2.2 West Shore

The Do Something 1 should meet the objectives of the Council as well as the community; there will be continued use of the beach with only limited shingle added at certain locations to reduce the volume of windblown sand. This option, particularly when combined with recommendation from the Tourism Strategy (AECOM, 2019), will work towards achieving the seven well-being goals.

In the long term Do Something 1 is likely to suffer from problems with the rise in sea level causing increased overtopping. Additional works could be completed here in order to remove the threat however the long-term policy of managed realignment would mean a future scheme is likely to be on a step backed line. The scheme by itself is unlikely to offer increased green potential to the frontage.

Do Something 2 provides a wall extension across Dale Road car park to the sand dunes that could be designed to incorporate a footpath and planting. The footpath would increase the available hard space for users in a wheelchair or with a pushchair along the frontage. The design of the wall means it also meets the flood risk objective of CCBC. The well-being goals can further be met on this scheme if recommendations from the Tourism Strategy (AECOM, 2019) are carried out in tandem; it will help to increase the community value of the area as well as help boost the local economy. The wall itself can be designed to be adaptable and raised if required. However, the long term SMP2 plan of managed realignment doesn't support the wall being raised but the development of a community-based scheme at retreated distance.

The final scheme, Do Something 3, combines all the benefits of the first two options with additional well-being benefits and possible improvements in flood and erosion protection. The raised walkway provides increased accessibility along the frontage as well as easier use of the cycle way from the reduction in windblown sand along the route. Sand traps will cause a reduction in windblown sand to the properties along the frontage and could help further develop the existing dune system. A reduction in windblown sand would have a positive economic benefit to the residents, with a reduction in the cost of cleaning drives, buildings, and cars and for the Council with a reduction in annual clean-up costs.

3.6.3 Environmental Performance

An EAR has been completed to support the OBC and can be found in **Appendix C**. A summary of the key ecological, heritage and visual Impacts can be found below.

Landscape

North Shore Mitigation

Based on the current scheme and baseline information none of the options are likely to result in significant effects to landscape character or visual receptors. However, effects on landscape and visual receptors will depend on the potential over provision of engineering features within the landscape, which is likely to detract from the amenity of

the beach. As the detailed design develops landscape and visual effects will need to be taken into account to optimise the design and ensure it is incorporated into the wider landscape setting as much as possible (e.g. the height, form, materials and façade of any new sea walls is yet to be determined).

Mitigation measures will be proposed if considered appropriate subject to a suitable level of impact assessment and consultation with NRW and Conwy County Borough Council. These may include ensuring a suitable choice of materials (e.g. for the traditional groynes within Option 3) to complement local vernacular.

If the flood prevention measures could be considered holistically as part of wider public realm improvements, then there is real potential that the improved environment could provide additional economic growth benefits.

West Shore Mitigation

Mitigation measures will be proposed if considered appropriate. These may include complementary environmental/public realm improvements ensuring a suitable choice of materials to complement the local vernacular.

Need for Further Assessment

Further assessment would be based on the principles of the Guidelines for Landscape and Visual Impact Assessment (2013). Any future assessment would need to consider the construction and operational phases of the proposals and would be aligned to the scope of environmental assessment required to support future planning and marine licence applications, that may or may not require a statutory Environmental Impact Assessment.

Further study would also be required to assess the effect on the townscape and neighbouring communities. For the purpose of identifying the composition and relative sensitivity of the baseline of the urban area, it would also be beneficial to group the immediate setting of the North Shore into broadly homogeneous Townscape Character Areas (TCAs). Detailed visual assessment and site survey would be required to assess the effect on identified visual receptors.

Heritage

Heritage has been assessed to inform the options development of the BMP using data collected from the Gwynedd Archaeological Trust (GAT) Historic Environment Record (HER) and Coflein. A Heritage Assessment is included within **Appendix C**.

North Shore Impacts

Several of the options may have a direct adverse impact upon the site of the prehistoric submerged forest which is evidenced at Llandudno Beach and identified within the Heritage assessment. The potential extent of this effect is unknown at this stage as the historic significance of the remains is not well understood. Options 1a and b would potentially have a physical effect on the Grade II listed pier if the breakwater is tied into the structural supports of the pier. Where secondary sea walls are proposed there may be permanent adverse impacts on the on the setting of listed buildings. There may also be adverse impacts from the construction or nourishment activities on previously unrecorded heritage assets and archaeological deposits.

The beach nourishment and construction activity (Do Something 1) may adversely impact upon the site of the prehistoric submerged forest due to a physical effect on the remains. There may also be adverse impacts derived from the construction of the fishtail groynes. There will also potentially be an adverse effect on the setting of the listed buildings from the fishtail groynes on the beach. There may also be limited adverse impacts and a limited effect on the setting of the listed buildings from derived from the construction the traditional groynes on the beach.

The beach nourishment may have adverse impact upon the site of the prehistoric submerged forest and Llandudno beach (Do Something 2).

West Shore Impacts

Several of the options would have no or only limited adverse impacts on the historic environment. Only one of the options may have a direct adverse impact upon the medieval fish traps / weirs, which are an important local heritage asset. Some options may also adversely impact upon the setting of the listed buildings in the area by the introduction of the proposed secondary sea walls. Finally, there may also be limited adverse impacts derived from the construction or maintenance activities on previously unrecorded heritage assets and archaeological deposits.

Do Something 1 will maintain the current situation by only removing excess sand, which could then be used elsewhere on this frontage (for example to support sand dunes) or at the North Shore. There would be no effect on previously recorded heritage assets.

Do Something 3 would have limited potential for physical effect on previously unrecorded archaeological deposits from the construction of the wall. There will potentially be an effect on the setting of the listed buildings and other non-designated heritage assets from the construction of the wall.

Mitigation

Mitigation measures could include the use of materials sympathetic to vernacular material choices for the construction of walls and walkways. Further investigation into the effect of the options on the submerged forest and the medieval fish weir will also be required, along with recording of any affected remains.

For the North Shore, it is recommended that further assessment of the effect of the proposed options on the setting of listed buildings and of the effects on the submerged forest should be undertaken.

For the West Shore, it is recommended that further assessment of the effect of the proposed options on the setting of listed buildings and other heritage assets. In addition, an assessment and review of the remains of the medieval fish weir should be undertaken and appropriate mitigation developed.

Ecology

Impacts

The site visit and desk study identified a number of ecological features associated with the Proposed FAS. The presence of wintering birds, notably gulls, and the potential for waterbird species associated with the West Shore intertidal zone, in particular, was recorded. The terrestrial habitats recorded on site have the potential to provide breeding opportunities for a number of bird species, notably passerines. Habitat recorded within part of the West Shore was also noted as being suitable for reptiles.

Detailed recommendations will be provided once a more detailed project/scheme plan has been decided on and specifications regarding works are available.

Based on current information in the Options Report (Appendix F), the works proposed for the North and West Shore are considered to potentially have impacts on wintering bird species associated with Traeth Lafan/Lavan Sands, Conway Bay SPA, as detailed within the HRA, the Shores have the potential to support a considerable proportion of some SPA qualifying species, particularly oystercatcher (~10% of the SPA population). Therefore, without Site specific wintering bird surveys, which would determine usage of the Site by focal species (particularly oystercatcher), this assessment cannot discount the possibility for Likely Significant Effects to occur relation to disturbance of birds from the SPA feeding in close proximity to the proposed works.

It is also recommended that works should be undertaken during periods of fair weather, avoiding extended periods of very cold or very hot weather, heavy snow, hail or rain and thick fog. Where possible, works should also commence at low tide, allowing birds potentially susceptible to disturbance to access larger areas of habitat further away from works and become habituated to works. It should be noted that bird surveys will be required to inform the seasonal periods in which construction would be permitted.

Furthermore, construction works have the potential to release toxic chemicals and dust from spillages. Such occurrences have the potential to be detrimental to biodiversity directly and indirectly (i.e. toxic chemicals passed on through the food chain) and to the water environment.

All options for the West Shore are considered to have the potential to impact intertidal mud/sand habitats neighbouring the Menai Strait and Conwy Bay SAC.

Construction works have the potential to release toxic chemicals and dust from spillages. Such occurrences have the potential to be detrimental to biodiversity directly and indirectly (i.e. toxic chemicals passed on through the food chain) and to the water environment. Where any chemicals are required these will be stored appropriately on site away from aquatic habitats and in bunded areas with isolated drainage systems. Vehicles carrying dusty materials will be covered and construction vehicles would conform to at least Euro III standards. Wheel wash facilities or road sweepers will be in place on entrance and exit points to construction sites in accordance with the Guidance for Pollution Prevention (GPP) 13 and vehicles made to use them.

Activities and materials exposed to wind will be protected. Water sprays/spray curtains to moisten construction/maintenance material will be used. Solid hoardings at least 2 m high will be installed to reduce the transfer of dust and air pollutants travelling to sensitive areas during construction.

Normal controls / licences will be required at a project level. However, the following mitigation measures will be included (subject to the detailed project level HRA) in the Coast Protection Strategy for these schemes:

- Good practices undertaken will be in accordance with the GPP series: GPP 1, GPP 2, GPP 5, GPP 6, GPP 7, GPP 8, GPP 18, GPP 21 and GPP 26.
- Measures to control the generation of sediment laden runoff will be implemented prior to and during construction.

Any vehicles that are required during construction would be inspected before, and regularly during, their use. Drip trays would be fitted where appropriate and spill kits would be made available if required. Emergency plans in the event of a spillage would be developed.

3.6.4 Efficiencies and Carbon Performance

A detailed carbon calculation has not been undertaken for each of the options or combination of options proposed. However, a relative scoring for each of the options has been compared for each frontage assessing the predicted carbon performance of each scheme relative to each other. See **Table 3-7** and **Table 3-8**.

Table 3-7: Carbon Performance. North Shore:

Option	Summary
North Shore – Do Something 1 *Beach nourishment with shore connected structures such as fishtail or timber groynes*	The removal of any cobble and replenishment with sand and timber groynes along the North Shore would likely be a high carbon operation due to the amount of plant required along with the amount of new material that would need to be imported. Also, the disposal of the cobble material would need to be considered i.e. waste facility or another site which would also provide an increase in the carbon due to the costs of transporting large volumes of material. Sourcing appropriate sustainable timber would also be difficult as this location is likely to require greenheart timber which is not a sustainable material. Also, in the future, the existing rear wall will be required to be replaced/raised with either insitu concrete or precast. The likely relative carbon output in comparison to the other North Shore options is considered to be **Very High.**
North Shore – Do Something 2 *Beach Nourishment Alone*	The removal of any cobble and replenishment with sand without control structures along the North Shore would likely be a high carbon operation due to the amount of plant required along with the amount of new material that would need to be imported. Without the installation of the control structures, there could potentially be a more frequent loss of material and therefore an increase in the carbon due to transportation costs. The disposal of the cobble material would need to be considered i.e. waste facility or another site which would also provide an increase in the carbon performance due to the costs of transporting large volumes of material. Sourcing appropriate sustainable timber would also be difficult as this location is likely to require greenheart timber which is not a sustainable material. Also, in the future, the existing rear wall will be required to be replaced/raised with either insitu concrete or precast. The likely relative carbon output in comparison to the other North Shore options is **High**.
North Shore – Do Something 3 *Business as usual with the raising of the rear promenade wall before year 50*	Period beach maintenance would be undertaken when the levels of the sand/cobbles are low. Currently, we have estimated that re-alignment of the existing shingle to be undertaken every two years with cobble replenishment every 20 years. In the future, there will be a requirement to raise or replace the existing rear flood wall to account for climate change. The likely relative carbon output in comparison to the other North Shore options is considered to be **Medium**.

Table 3-8: Carbon Performance. West Shore;

Option	Summary
West Shore – Do Something 1 *Periodic beach maintenance*	This option allows for sand to be moved along the frontage to low areas. This will require reasonably large plant but should not be a long operation (circa 2-3 weeks work). There is also an allowance for additional shingle to be added which will require transport of suitable material to site. The likely relative carbon output in comparison to the other North Shore options is considered to be **Medium**.
West Shore – Do Something 2 *Wall Extension*	The installation of a new wall would be extending approximately 300m south from the existing hard defences would require considerable amount of plant, construction activity and materials. The wall would consist of RC concrete and require removal of material for the placement of the foundations. The likely relative carbon output in comparison to the other North Shore options is considered to be **High**.
West Shore – Do Something 3 *Combined Scheme*	This option would include for the works in DS1 and DS2 but also includes for a raised walkway and provision of the to control the sand. This will increase the overall construction operation and the plant requirements. The raised walkway could potentially be made from timber. The material could be sourced from sustainable local sources but depending on the design and specification of the material required, there may be a significant increase in the overall carbon output during construction. The likely relative carbon output in comparison to the other North Shore options is considered to be **High** although noting that there could be a significant increase if the installation of timber walkway is constructed from a non-sustainable source.

During the detailed design and investigation stage, it may be possible to find opportunities to work alongside project partners and stakeholders in terms of sourcing materials and sharing resources for local schemes. Where neighbouring scheme promoters and authorities have works planned, the opportunity for efficiencies in delivery of the schemes through a joined-up approach to delivery should be investigated during the detailed design. At present, there are some neighbouring and local schemes which may coincide with the delivery of the Llandudno works.

The works at Llandudno can be broken down into a number of packages that can be delivered in the most efficient way, potentially using a number of Contractors. Any Civils works and wall installation could be potentially packaged with other works being undertaken by Llandudno with the beach management procured separately when required.

There is potential to reuse spoil from the removal of the existing seawalls/ defences but will be subject to contamination testing for suitability.

A reduction in the carbon footprint can be realised through locally sourced materials, where possible, and the use of the Port to import materials directly.

3.6.5 Economic Performance

A full methodology and assessment for the economic appraisal of options is included in the Economic Appraisal Report in **Appendix I**, including the breakdown of damages and the calculation of wider damages associated with the flooding of Llandudno The economic damages have been calculated in accordance with the Welsh Government guidance[12] and the Multi Coloured Manual (MCM)[13]. Data was taken from the hydraulic modelling outputs produced as part of the CTFRA and used to develop a Do Nothing and Do Minimum scenario. An integral part of CBA is establishing the baseline option of 'Do Nothing' (DN). 'The 'DN' Scenario represents the baseline for the appraisal (hypothetical situation and assumes a 'walk away' scenario where no maintenance to existing structures is undertaken. A Do Minimum 'DM' Scenario was then developed which assumes that repair maintenance is undertaken when required but no formal maintenance or asset refurbishment is undertaken by any party on a regular basis. Developing and comparing these scenarios are essential steps within the CBA of options and are used to assess the relative costs and benefits of various levels of intervention. They also provide comparators for which to assess the incremental benefits of additional investment or options to improve the SoP. No options modelling was undertaken as part of this study. The damages avoided (benefits) for the short list option have been calculated using the DN baseline economic spreadsheets and removing the damages below defence SoP. As the options have been determined to provide a set SoP, this method was chosen as the most suitable.

Table 3-9 summarises the benefits for the short-listed options. The table shows the flood damages, the monetary losses caused by a flood event, and the flood benefits, the damages avoided following the implementation of a Do Something Option. It has been assumed that works will need to be carried out on both the North and West Shore to protect residential and commercial properties from the risk of climate change therefore the economics have been assessed using a combination of options for activities undertaken on both the North and West Shore.

Table 3-9. Benefits Summary

Scenario	Flood Damages (£,000)	Flood Benefits (£k)
Do Nothing	90,728	-
Business as Usual	74,916	15,812
Combination 1: North Shore DS1b, West Shore DS1	14,712	76,016
Combination 2: North Shore DS1b, West Shore DS2	14,712	76,016
Combination 3: North Shore DS1b, West Shore DS3	14,712	76,016
Combination 4: North Shore DS2, West Shore DS1	14,712	76,016
Combination 5: North Shore DS2, West Shore DS2	14,712	76,016
Combination 6: North Shore DS2, West Shore DS3	14,712	76,016
Combination 7: North Shore DS3, West Shore DS1	14,712	76,016
Combination 8: North Shore DS3, West Shore DS2	14,712	76,016

[12] Welsh Government Flood and coastal erosion risk management (FCERM): business case guidance
[13] MCM (2020) Flood and Coastal Erosion Risk Management Handbook and Data for Economic Appraisal 2020

Scenario	Flood Damages (£,000)	Flood Benefits (£k)
Combination 9: North Shore DS3, West Shore DS3	14,712	76,016

A summary of the whole life costs for the short listed options are provided in **Table 3-10** and **Table 3-11**. At this stage an optimism bias of 30% has been assumed for the project in line with the Welsh Government FCERM guidance (Supplementary Guidance Note 03) and the HM Treasure Green Book. A detailed cost breakdown can be found in **Appendix J**Error! Reference source not found..

Table 3-10. Capital Cost Summary – North Shore

Scenario	Costs (£k)
Business as usual	2,240
Do Something 1	19,290
Do Something 2	19,041
Do Something 3 (assuming rock groynes)	3,213

Table 3-11. Capital Cost Summary – West Shore

Scenario	Costs (£k)
Business as usual	1,971
Do Something 1	3,504
Do Something 2	4,197
Do Something 3	4,672

A more detailed breakdown of costs can be found in **Appendix J.**

A summary of the economic appraisal for each of the options is included in **Table 3-12.** For further details on the economic appraisal, refer to **Appendix I.**

Table 3-12 Benefit Cost Ratio Summary

Scenario	Present Value Flood Damages (£,k)	Present Value Flood Benefits	Present Value Costs	BCR
Do Nothing	£90,728	-	£342	
Business as Usual	£74,916	£15,812	£4,157	3.80
Combination 1: North Shore DS1, West Shore DS1	£14,712	£76,016	£22,794	3.33
Combination 2: North Shore DS1, West Shore DS2	£14,712	£76,016	£23,487	3.24

Scenario	Present Value Flood Damages (£,k)	Present Value Flood Benefits	Present Value Costs	BCR
Combination 3: North Shore DS1, West Shore DS3	£14,712	£76,016	£23,962	3.17
Combination 4: North Shore DS2, West Shore DS1	£14,712	£76,016	£22,545	3.37
Combination 5: North Shore DS2, West Shore DS2	£14,712	£76,016	£23,238	3.27
Combination 6: North Shore DS2, West Shore DS3	£14,712	£76,016	£23,712	3.21
Combination 7: North Shore DS3, West Shore DS1	£14,712	£76,016	£6,717	11.32
Combination 8: North Shore DS3, West Shore DS2	£14,712	£76,016	£7,410	10.26
Combination 9: North Shore DS3, West Shore DS3	£14,712	£76,016	£7,885	9.64

Please Note: Combination 7 (red box) is the economically leading options whereas the public and local stakeholders are requesting for Combination 3 (green box) to be proposed as the preferred scheme.

3.7 Select the Preferred Option

The options appraisal has been undertaken in accordance with the Welsh Government FCERM guidance. The preferred option for North Shore is Do Something 3 which is to continue with business as usual and for the rear promenade wall to be raised before year 50. This option has the best BCR as well as meeting all the CSF. The preferred option for West Shore is the Do Something 1, Business as usual but with topping up with additional shingle.

The benefits of this preferred option are as follows:

- Increased flood protection for the town in the long term;
- A delay in the main capital works allows time for funding to be found for the scheme;
- Limited environmental impact in the area as constructing atop the existing rear promenade wall and the wall could be designed to incorporate planting;
- Aligns with Shoreline Management Plan and Council objectives; and
- The least expensive option available for the frontage.

The benefit density map in **Figure 3-1** overleaf shows the areas benefiting from the proposed scheme at the end of the Appraisal Period.

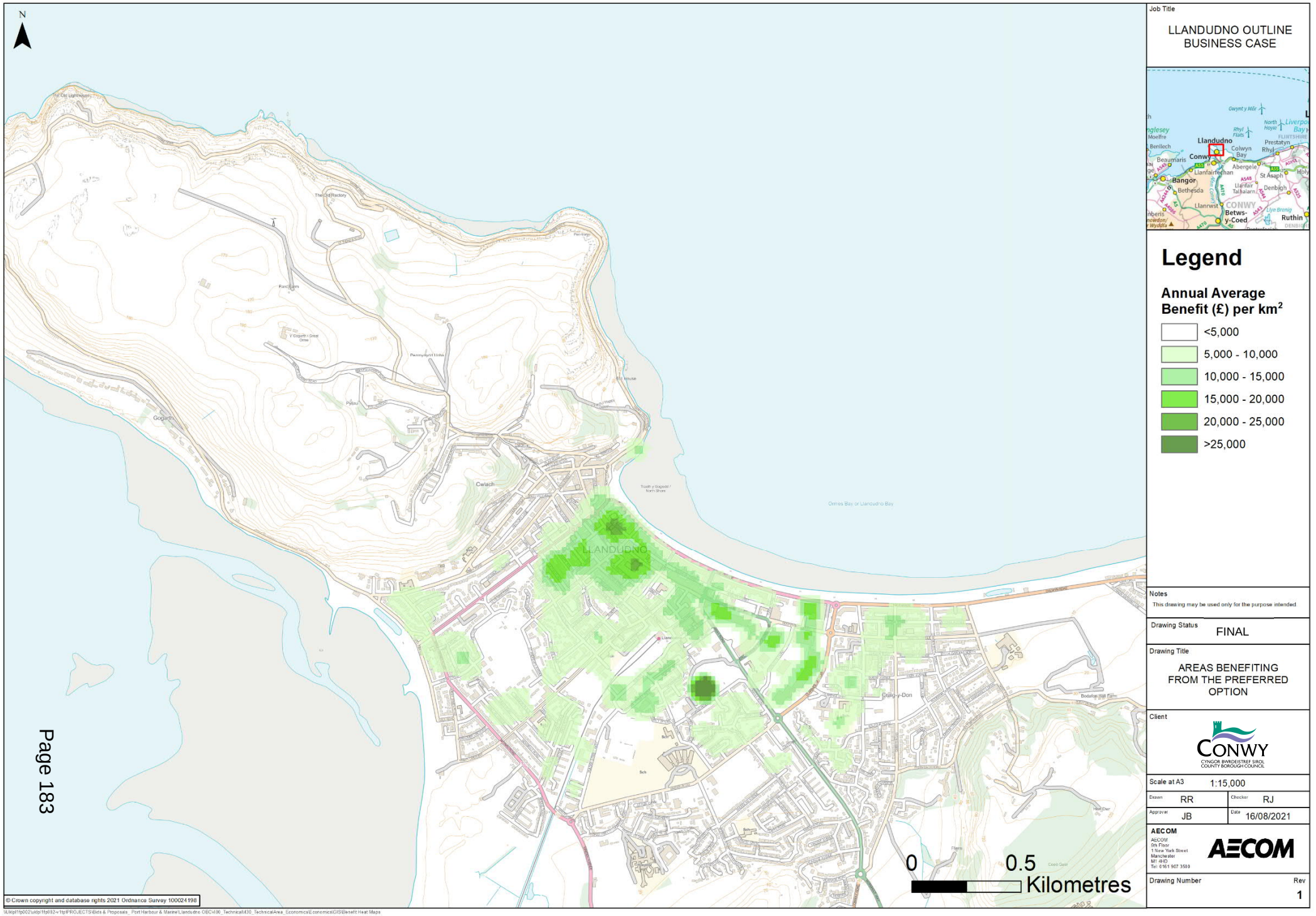

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Figure 3-1: Heat Map showing the Areas Benefiting from the Scheme at the end of the Appraisal Period

3.8 Further Development and Testing of Preferred Option

3.8.1 Concept Design and Assessment of Cost

Concept designs of the Preferred Option can be found in **Appendix K** and costings can be found in **Appendix J**.

3.8.2 Sensitivity Testing

Sensitivity testing of the preferred option was carried out using and is detailed in the EAR in **Appendix I.**

3.9 Engineering Summary; Preferred Options

For the preferred options, for North and West Shore there would be a requirement for the installation of a new wall before year 50 to counter the effects of climate change along with ongoing beach maintenance/management along the coastline. As part of the design, the determination of the crest level was required to ensure that Llandudno was protected by the effects of Climate Change adding flood resilience to the coastline and to the town of Llandudno. It was determined that the crest level required for the protection for the coastline would be in the region of 6.5-6.6mAOD but this will need to be verified during the detailed design stage when further modelling work commences. The walls have been designed to counter the potential failure modes of sliding, overturing, and bearing failure. The walls have been sized and designed based on the anticipated forces from still water levels and potentially from waves with an appropriate safety factor. See **Appendix K** for full details of the concept designs and a summary of the engineering philosophy.

4. Commercial Case

4.1 Procurement Strategy

4.1.1 Introduction

CCBC have commissioned AECOM to carry out a study and review the potential for coastal defence improvements at Llandudno North Wales by availing of funding through the Welsh Governments Coastal Risk Management Programme (CRMP).

Whilst the review principally focusses on coastal defence, wider benefits in line with the Wellbeing and Future Generations Act have also be considered and recommended where appropriate.

The Flood Risk and Infrastructure (FRI) Team within CCBC will project manage the process building on the experience gained in the delivery of Welsh Government funded coastal projects recently completed along the Conwy coastline.

Subsequent to the submission and acceptance of this Business Case by the Welsh Government, the FRI team will seek to procure a suitably qualified and experienced Consultant to carry out the detailed design of the preferred and agreed option.

Once a detailed design has been completed, a tender package for the construction works will be prepared and tendered with suitably experienced contractors.

4.1.2 Strategy

The FRI team will prepare the tender documentation both for the procurement of the Consultants and Contractor on the open market and use Sell2wales and the NPS frameworks where appropriate taking advantage of a simplified, sustainable tendering process resulting in efficiencies in time and cost.

CCBC will use its extensive experience in dealing with the Marine Licencing Team and the NRW, the Crown Estate, Local Fisherman Organisations, the Coast Protection Authority, Llandudno Coastal Forum (LCF), Town Councils and resident groups to facilitate the process.

Procurement will be made in accordance with the European Directives and a notice will be published on the Sell2Wales website and in the Official Journal of the European Union (OJEU) should the estimated OJEU limits be exceeded.

CCBC's recently developed Corporate Plan 2017-2022 specifically aligns itself with the 7 goals outlined in the Wellbeing and Future Generations Act and sustainability will be at the heart of any commissioned project. A summary of the report is located in the Strategic Case.

CCBC will strive to achieve value for money for the Welsh Government and pursue the goals outlined in "Delivering Maximum Value for the Welsh Pound – 2014".

As with previous CCBC projects, additional Z clauses will be inserted into the contracts to define the Community Benefits that will have to be achieved as part of the works. These have in the past included requirements for local spending where possible, prompt payment of suppliers and defined training for young workers.

4.2 Key Contract Terms and Risk Allocation

4.2.1 Contract Duration

Based on CCBC's extensive experience in delivering coastal defence works (e.g. recent works have been undertaken at Llandudno and Colwyn Bay), it is proposed that the public consultation, detailed design and project approvals could take place in the 2020/21 financial year with construction following on in 2021/22 financial year.

4.2.2 NEC Contracts

CCBC will use the NEC suite of contracts to administer the projects – NEC Professional Services Contract (PSC) Option A for the detailed design and NEC Engineering and Construction Contract (ECC) Option A for the construction works. NEC contracts have been used by CCBC on all recent coastal projects and provide flexibility and standardisation in contract preparation and administration.

The Option A payment mechanism – i.e. priced contract with activity schedule – has been chosen to minimise the estimating risk to CCBC and it is expected that both the Scope of Services (PC) and the Works Information (ECC) will be well defined in advance of tendering. The outline Activities will be prepared by CCBC with the Consultant/Contractor choosing to subdivide for payment purposes and providing a direct link between progress and payment.

Roles and duties are clearly defined in the NEC with the Employer, Project Manager, Supervisor, Contractor, Subcontractors and Adjudicators clearly identified. Contracts will be executed in a spirit of "mutual trust and co-operation" as defined in Cl 10.1 of both contracts and early warnings and risk reduction meetings will be used to mitigate any possible compensation events.

4.2.3 Risk Allocation

The NEC contract is a tool to manage risk and avoid disputes and to this end CCBC will be open and upfront with their partners. However, in the tender documentation provided, CCBC shall aim to reduce its risk and provide the Consultant/Contractor the opportunity to price any residual risk into their activity schedule.

Both CCBC and Consultants/Contractors will complete the sections in the contracts identifying the matters to be included in the Risk Register at the outset of the process which may be notified as early warning matters. This Risk Register is a post contract risk management tool and shall be used to avoid and reduce risk during the execution of the contract. Any risk not taken and priced by the Contractor would subsequently become a compensation event as identified in cl 60.1 of the contract documents.

Typical CCBC risk items would include, NRW and 3rd party approvals, planning consents, funding constraints, time constraints, exceeding time for delivery, exceeding budget, working in a marine environment and public buy in for the proposed project The Consultants/Contractors shall identify their perceived risks in Contract Data part 2.

Secondary X clauses shall also be used to allocate risk relating to inflation, law, and any Contractors design. Additional Z clauses will be also inserted into the tender documents if required.

4.3 Procurement Route and Timescales

4.3.1 Procurement of Design Consultant

It is likely that the Design Consultant for the scheme will be procured using the National Procurement Service (NPS) Construction Consultancy Framework relevant to coastal schemes with tender documentation posted and managed through the Sell2wales portal.

Tender documentation shall be prepared by suitably experienced Officers from the FRI team.

The NEC Professional Services Contract shall be used to engage the Design Consultant with the tenders being assessed typically on a 70%:30% quality: price basis.

Greater bias will be given to price at this stage as the Consultants on the NPS have already satisfied extensive quality conditions on the NPS framework.

The Quality Submission for the Design Consultant could consist of five weighted criteria which will require responses and shall be ranked (see **Table 4-1**)

Table 4-1 Typical weighting criteria for Design Consultant assessment

Description	Percentage of overall mark
Details and approach to quality management of the Contract.	15%
Consultant's understanding of the brief and the outputs required under the Contract including approach to working with the Employer.	30%
The Consultant's proposed methodology for undertaking the Contract.	20%
The Consultant's Key Resources to be utilised to deliver the Contract.	20%
Consultant's proposed delivery programme.	15%

Tender evaluation in accordance with the Instructions to Tenderers shall be carried out and the award of contract shall comply with of CCBC's Contract Procurement rules.

4.3.2 Procurement of Consultant

Tender documentation shall be prepared by suitably experienced Officers from the FRI team using input provided during the OBC stage.

It is proposed that the NEC PSC Option A shall be used for the proposed design works which reduces the risks to the employer.

5. Financial Case

5.1 Financial Scale and Breakdown

It is proposed that further consultation takes place in order to develop a consensus on the final option. The proposed spend profile for the preferred option is shown in **Table 5-1**. The preferred option at present is the shortlisted option with the highest BCR value of the options examined.

Table 5-1. Proposed Spend Profile, Preferred Option

	Cash Costs (£k)
Previously approved costs (up to OBC)	341
Design and Consultancy	46
Capital Costs	460
Maintenance Costs	4,399
Optimism Bias	1,471
Project Total	**£6,717**

The spend profile for the alternative option is shown in **Table 5-2**. The alternative option at present is the option which the public are favouring but has a BCR of 3.17.

Table 5-2. Proposed Spend Profile, Alternative Option

	Cash Costs (£k)
Previously approved costs (up to OBC)	341
Design and Consultancy	1,693
Capital Costs	10,676
Maintenance Costs	5,801
Optimism Bias	5,450
Project Total	**£23,961**

5.2 Funding Sources and Timescales

The proposed sources of funding are shown in **Welsh Government** funding is being applied for through this document for 100% funding of the design and development costs and 85% of the scheme construction costs under the WG Coastal Risk Management Programme 2016 – 2021.

CCBC have approval to finance the 15% allocation of the overall project budget from internal Council resources and external partners.

The funding requirements in **Tables 5-3** and **5-4** detail the split between the proposed funding between Welsh Government (85%) and Conwy (15%). The design fees have been split assuming 25% of the work will be undertaken in Year 0, with the remaining 75% in Year 1. Construction fees have been split between Years 1 – 4 at 25%, 40%, 30% and 5% respectively.

Table 5-3 for the preferred option.

Welsh Government funding is being applied for through this document for 100% funding of the design and development costs and 85% of the scheme construction costs under the WG Coastal Risk Management Programme 2016 – 2021.

CCBC have approval to finance the 15% allocation of the overall project budget from internal Council resources and external partners.

The funding requirements in **Tables 5-3** and **5-4** detail the split between the proposed funding between Welsh Government (85%) and Conwy (15%). The design fees have been split assuming 25% of the work will be

undertaken in Year 0, with the remaining 75% in Year 1. Construction fees have been split between Years 1 – 4 at 25%, 40%, 30% and 5% respectively.

Table 5-3. Proposed Funding Profile, Preferred Option

Annualised Profile (£k)	Sunk	Year 0	Year 1	Year 2	Year 3	Year 4	Year 4+	Total
Welsh Government	-	9	158	208	156	26	-	520
CCBC	341	2	28	37	28	5	5,719	6,197
Project Total	**341**	**11**	**186**	**245**	**184**	**31**	**5,719**	**6,717**

Similarly, the proposed sources of funding are shown in **Table 5-4** for the alternative option.

Table 5-4. Proposed Funding Profile, Alternative Option

Annualised Funding Profile (£k)	Sunk	Year 0	Year 1	Year 2	Year 3	Year 4	Year 4+	Total
Welsh Government	-	1,079	3,417	4,891	3,668	611	-	12,227
CCBC	341	191	603	863	647	108	7,542	11,734
Project Total	**341**	**1,269**	**4,020**	**5,754**	**4,315**	**719**	**7,542**	**23,961**

CCBC is accountable under Section 151 of the 1972 Local Government Act 'Financial Administration' to administer the financial affairs of the authority by one designated financial officer. The Section 151 Officer (or Chief Financial Officer) has the duties and powers to alert the Councillors and the Auditor in the case of unlawful expenditure, and therefore sets the standards that the Council must adhere to and provides an internal check that they have been met.

CCBC, as a local authority, is required to have an annual external audit under Section 2 of the Audit Commission Act 1998. The general duties of the external auditor under Section 5 of the Act include ensuring the compliance with requirements of all statutory provision applicable to the accounts.

In addition, CCBC will ensure that a robust governance framework is in place through which accountability for the regularity and propriety of flood and erosion defence Grant in Aid funding can be clearly defined.

CCBC will act as the accountable body for the project and will be responsible for performance and compliance to ensure the activities supported fit within the programme objectives, are value for money and are an efficient use of public resources.

Each phase of the project will be managed through a system of robust appraisal and monitoring throughout the life of the programme as well as being responsible for the delivery of the programme. Auditing systems are already in place and these will be adapted to suit the specific requirements of the programme.

Alongside the Project Manager to be appointed to the programme, CCBC will utilise its in-house programme delivery team (PDT) who have considerable contract delivery/management/performance knowledge. Specialist advice will also be sourced to assist with the due diligence elements of the programme.

The PDT will also utilise the support of colleagues from other relevant services such as legal, finance, risk, and procurement, to ensure that all elements of the delivery of the programme are compliant.

The Project Manager will maintain both hard and soft copy files relating to all project activity including expenditure (copy invoices, originals held by CCBC accounts), correspondence with the managing authority, publicity, funding agreements and supplier contracts.

The PDT will routinely audit the claims produced to ensure that probity is maintained and to track the performance of individual projects.

5.3 Financial Summary

Summary of the financials for the preferred scheme can be seen in Table 5-5.

Table 5-5. Financial Summary (excluding sunk costs), Preferred Scheme

Funding Sources	Year 0 (£)	Year 1 (£)	Year 2 (£)	Year 3 (£)	Year 4+ (£)	Total
Welsh Gov'	9	158	208	156	26	520
CCBC	2	28	37	28	5,724	6,053
Sum of funding requirement per year	**11**	**186**	**245**	**184**	**5,750**	**6,376**

Summary of the financials for the alternative scheme can be seen in Table 5-6.

Table 5-6. Financial Summary (excluding sunk costs), Alternative Scheme

Funding Sources	Year 0 (£)	Year 1 (£)	Year 2 (£)	Year 3 (£)	Year 4+ (£)	Total
Welsh Gov'	1,079	3,417	4,891	3,668	611	12,227
CCBC	191	603	863	647	7,650	10,853
Sum of funding requirement per year	**1,269**	**4,020**	**5,754**	**4,315**	**8,261**	**23,619**

Assumptions for the above costs:

- Local Authorities like CCBC are able to fully recover VAT incurred where this is in connection with their non-business activities such as coastal protection.
- The economic case excludes VAT
- The contributions from 'others' is to be confirmed by CCBC during design and approval phases. All future maintenance costs are assumed to be funded by local funding streams apart from when capital maintenance is required.
- It is assumed the capital maintenance will be funded by the WG.

6. Management Case

6.1 Project management (including health, safety, and well-being)

This section explains how CCBC will manage the procurement and delivery of the project; including the detailed design, construction, wider benefits, public engagement, and the approach to risk management up to and after the completion of the works.

6.1.1 Project Structure and Governance

Building on the experience gained in the delivery of recent construction projects such as Colwyn Bay Waterfront and the 2014 emergency works, the FRI team will manage and deliver this project on behalf of CCBC.

The Project Director shall appoint the Project Manager for the proposed scheme who is responsible for day-to-day development of the project and co-ordinates the actions of the Project Team and external consultants.

The Project Manager is responsible for regular communication with the Project Director who in turn reports to the Councils Scrutiny Committee and ultimately the Council Cabinet at key stages during the development of the project.

The Project Manager shall be assisted by Officers from various services from CCBC that are affected by the proposed works. The Project Team reports to and is coordinated by the Project Manager and is responsible for undertaking any activities which may be necessary to advance the project and for providing feedback to the Project Manager on the effect of any proposals on Officer's individual services. As required, members of the Project Team will assist with management of externally appointed consultants and contractors undertaking works relevant to their service. See **Table 6-1** for team setup.

Table 6-1 Project Team

Role / Responsibility	Name
Flood Risk & Infrastructure Manager – Project Director	Owen Conry
Project Manager	TBA
Designer	Mott MacDonald
Ecologist	Kate Surry
Environmental Officer	Simon Cottrill
Project Liaison Officer	Benjamin Poulton

6.1.2 Project Plan

It is proposed that the Llandudno FAS shall be delivered by the FRI team for CCBC using the funding provided by the Welsh Government, CCBC supported borrowing and any external sources/stakeholders that may contribute.

The detailed design shall be carried out by an external Consultant experienced in coastal defence projects after competitive tendering process. Subsequently the FRI team will prepare the tender documentation for the construction contract. The detailed design can commence in the financial year 20/21 and 21/22 whilst the delivery of the construction project could be started within the financial year 2021/22.

The FRI team will be guided by CCBC's Programme & Project Management Framework and the CAMMS Integrated Project Manager software to deliver this project with the aim of reducing risk and supporting the delivery of the Corporate and Service outcomes.

Table 6-2 provides an overview of the key activities and key dates for the delivery of the scheme.

Table 6-2 Proposed Key Project Milestones

Activity	Date	Comment
Submission of OBC to WG	10/21	
Feedback from WG	11/21	
Tender and Appointment of Design Consultant	09/21	Mott MacDonald
Receipt of Detailed Design	01/22	Detailed Design has commenced. This will include consultation/feedback from stakeholders
Permitting and approvals	2/22	NRW Marine Licence/planning permission
Preparation of Construction Contract	12/12	
Planning Permission Granted	2/22	
Tender for Contractor for Works	01/22	
Appointment of Contractor for Works	02/22	
Works Completion	11/22	

6.1.3 Contract Management

The FRI team will manage this project on behalf of CCBC and a Project Manager with relevant experience will be appointed to implement the scheme from initial detailed design through to tendering, construction, and completion. The Project Manager will report to the Project Director who sits on the Local Authorities Strategic Leadership team (SLT).

The NEC suite of contracts shall be used to procure Professional Services and Construction works with the aim of working “in the spirit of mutual trust and Co-operation.”

The Project Manager shall be proactive and actively support the use of early warnings, risk reduction meetings, implementation of the contract.

6.1.4 Change Management

Any changes proposed/required to the project shall be treated through the project’s hierarchical structure. The instigator of the change shall discuss the requirements with the Project Manager in the first instance and the details of the change recorded.

The details shall include the nature of the change, the extent of the change, the reason for the change, the implications of not making the change and any other consequences of making the change (e.g. any effect on Project Risks).

Once finalised the change shall be requested through the Project Director who shall consider the change request and liaise as necessary with the Project Manager.

6.1.5 Benefits Realisation

Future management arrangements will be put in place to ensure that the project delivers its anticipated benefit. This can be done by incorporating the asset into CCBC’s Infonet data base where coastal assets are inspected every year with the more critical locations reviewed every 3 months. Defects which have been identified can be addressed as part of the coastal term maintenance contract.

CCBC conduct yearly surveys of the Conwy coastline as part of its commitment to the Welsh Coastal Monitoring Centre (WCMC). The FRI team are responsible for this inspection regime and are well placed to carry out post

project evaluation to ensure that the benefits identified in the economic case have been realised on site with the project delivery. It is anticipated that a benefits realisation strategy could be put in place for tracking purposes.

The key long term benefit with this scheme is to reduce flood risk by the implementation of improved flood defences. Secondary, wider benefits will be achieved as part of the contract realisation.

6.2 Risk Management

CCBC will aim to identify, assess, and control the risks that arise during the delivery of the project and use the CAMMS project management tools to this end.

CCBC will put in place a risk management strategy to identify and record risks in advance of materialisation and provide appropriate mitigation measures where needed.

Where possible risks shall be mitigated through early consultation, considered contractual drafting including detailed works/site information, possible use of non-traditional construction methods such as pre-cast concrete and commencing works in a favourable time of the year i.e. spring through to autumn.

The results of the risk analysis are presented in Table 6-3. A high level risk schedule and mitigation is provided below for the design stages of the project.

Table 6-3 Summary of Project Risks

Key project risk	H/M/L	Owner	Mitigation measure
Site Surveys			
Ecological surveys identify protected species	M	Customer	Ecological survey and early communication
Inadequate or late structural or geotechnical surveys	M	Customer	Geotechnical survey and early communication
Structural survey identifies addition repairs	L	Customer	Structural survey and early communication
Geotechnical survey identifies need for design changes and / or additional repairs	M	Customer	Geotechnical survey and early communication
Design Stage			
Detailed design requiring modifications from concept design	L	Consultant	Check Site surveys have been incorporated into design. Check Design work
Additional maintenance access required by maintenance team	L	Consultant	Check that design includes required facilities
Additional Public access required, arising from stakeholder's engagement	L	Consultant	Check that design includes required facilities
Future sea level rise more rapid than expected	L	Customer	Early identification, and design / plan in place for addition works
Design changes introduced by Client after award of contract	M	Customer	Avoid by ensuring design is finalised before award of construction contract

Key project risk	H/M/L	Owner	Mitigation measure
Delays in procuring Environmental Statement and EIA if required	M	Customer	Early submission
Consultations and Approvals			
Failure to identify all necessary consultees and third parties, and necessary approvals	H	Consultant	Early submission and meet with consultees and third parties
Difficulty in consulting with consultees	M	Consultant	Early submission and meet with consultees and third parties
Marine Licence approval	M	Consultant	Early submission and meet with consultees and third parties
NRW Assent to work within SSSI or SAC areas	M	Consultant	Early submission and meet with consultees and third parties
Planning application	M	Consultant	Early submission and meet with planners
All other approvals	M	Consultant	Early submission and meet with consultees and third parties
Costs associated with major legal process / CPO or public enquiry	H	Customer	Early submission and meet with consultees and third parties
Procurement & Construction			
Tendering process and selection of contractor	L	Consultant	Early planning, including publication of notices where required
Additional structural or geotechnical investigation required	L	Contractor	Early identification, and plan in place for addition investigations
Protected species found whilst constructing works	L	Contractor	Use existing information, undertake pre-construction surveys, apply mitigation measures to discourage future use
Change to seawall transitions into existing structures	L	Contractor	Early identification, and design / plan in place for addition works
Stability of existing wall not as expected	L	Contractor	Early identification, and design / plan in place for addition works
Change to scour protection design	VL	Contractor	Early identification, and design / plan in place for addition works

Key project risk	H/M/L	Owner	Mitigation measure
Change to scour protection length	L	Contractor	Early identification, and design / plan in place for addition works
Pollution incident / foreign material originating on site	L	Contractor	Monitor works and record activity / incidents (on and off site)
Archaeological feature discovered	VL	Contractor	Undertake watching brief during excavation
Storm / flood incident damages constructed works	VL	Contractor	Early identification, and design / plan in place for addition works
Storm / flood risk	VL	Contractor	Early identification, and design / plan in place for addition works
Unforeseen legislative change	VL	Customer	Early identification
Programme/ budgetary changes introduced by Client after award of contract	VL	Customer	Early identification
Client Specific Risks			
Delay in or failure to identify 25% for funding	L	Customer	CCBC to source 25% funding from third parties and supported borrowing

6.3 Post-project evaluation

Once the construction project has been completed the revised sea wall will enter into CCBC's Coast Inspection Area defence length register which will be monitored on an ongoing basis by the FRI team as part of the routine inspection regime.

The post project evaluation shall be carried out initially by the PM and in the long term by the Flood Risk and Infrastructure Manager who will confirm that the benefits identified in the economic case have been realised and that he project has delivered on its objectives. This will feed into the Lessons Learn Vault hosted by CCBC.

6.4 Future Stakeholder Engagement

The next phase of the project will focus on the confirmation of the selected options through Local Authority review and Stakeholder Engagement. A Stakeholder Engagement Plan has been prepared and is attached in **Appendix L****Error! Reference source not found.**. This document details the approach to Stakeholders which in principle is an inclusive approach aimed at identifying all constraints and opportunities at an early stage.

After feedback from WG and at the beginning of the design phase, the Stakeholder Engagement Plan will be reviewed and updated as necessary. This shall include a Stakeholder register devised of the identified affected parties of the project including statutory bodies, landowners, Town Council, County Councillors, residents, businesses, utility providers and other relevant infrastructure managers (). The register shall be maintained by the Project Liaison Officer and used to track communications and feedback.

CCBC will explain the options to the community through a public meeting or presentation. This has worked successfully in the past for the BMP and on other projects in the local area including the Colwyn Bay Waterfront project.

CCBC will contact the Town Council and explain the proposed works with the aim of taking on board their comments and concerns. Local County Councillors and residents will also be consulted. The FRI team have previous experience in dealing with the sensitivity of this project through the community liaison completed during the BMP.

The Project Liaison Officer will also liaise with all relevant statutory bodies affected by the scheme including Natural Resources Wales, Crown Estate, Highways Department, landowners, residents, and Town Council.

The FRI team will produce bi-weekly newsletters to be emailed to Stakeholders and posted on public notice boards around the works once a Contractor has been appointed and the project goes to site.

All relevant utility providers will be contacted during the design phase to check for any clashes with the proposed works and to ensure the necessary health and safety measures are accommodated during the construction period.

All public communications will be in Welsh and English in line with the Local Authorities bilingual policy.