

CCA6.2 Emerging Preferred Option Multi Criteria Analysis

Core Criteria	Sub Criteria	Option 1	Option 1 Narrative (Do Nothing)	Option 2	Option 2 Narrative (Do Minimum)
Economy	Land Use and Third Party Assets		No land-take required as no works would occur.		No land-take required as no works would occur.
	Capital Expenditure		This Option would not include any capital costs		This Option would include minimal capital costs
	Maintenance Expenditure		No maintenance required for this option		This Option would rely on reactive repairs and maintenance. Maintenance would be ad hoc and emergency repairs
Safety	Health and Safety (Construction)		This Option would present the lowest Health and Safety risk for construction as no major works would take place.		This Option would result in localised remedial works being required. Minor works of this nature would be risk assessed by the contractor. However, these works may be undertaken under poor working conditions due to immediate risk to the railway.
	Health and Safety (Design Life)		As the defences deteriorate over time, health and safety risks to the public increase as parts of the defences fail. Failure of the defences could be sudden and catastrophic as the Do Nothing scenario does not include any monitoring or maintenance of the defences. As the defences fail, parts of the failed defences will likely create debris on the foreshore and in publicly accessible areas. The defences themselves will also become hazards. Climate change will lead to increased overtopping and flooding of the railway line and the hinterland, which without intervention will become extremely dangerous.		This Option will involve maintaining the defences through reactive repairs. Therefore as there will be no proactive monitoring or maintenance, deterioration of the defences will occur and there are likely to be periods where there are Health and Safety risks in the defence prior to repair works being undertaken. The frequency and scale of the damage and repair works will increase over time. This Option does not include any improvement or upgrades to the defences to account for climate change therefore increased overtopping and flooding of the railway line will occur over time which poses Health and Safety Risks
Accessibility and Social Inclusion	Community		Option 1 (Do Nothing Scenario) is considered to have significant disadvantages over other options as any maintenance programmes currently taking place will cease under this scenario (however 'make safe' works would continue) with occurrences of coastal erosion and breach/collapse of existing erosion measures continuing and potentially getting worse in line with climate change predictions.		Option 2 (Do Minimum Scenario) is considered to have some disadvantages over other options as while any maintenance programmes currently taking place will continue under this scenario, occurrences of coastal erosion and breach/collapse of existing erosion measures will continue and potentially get worse in line with climate change predictions. Furthermore, the continuation of such coastal erosion has the potential to impact operational train services using the rail line in future years.
	Access		Option 1 (Do Nothing Scenario) is considered to have significant disadvantages to other options as the continuous erosion of the beach will result in the loss of the Greystones to Wicklow Walking Route that is routed immediately behind the beach in a north-south direction.		This Option is considered to have some disadvantages over other options as the continuous erosion of the beach will result in the eventual loss of bridge structures behind the beach which currently provide access.

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Core Criteria	Sub Criteria	Option 1	Option 1 Narrative (Do Nothing)	Option 2	Option 2 Narrative (Do Minimum)
	Social and Recreation Facilities		Option 1 (Do Nothing) is considered to have significant disadvantages over other options as under this option there is an increased risk to the recreational facilities from climate change effects(i.e. beach amenity areas) in this CCA.		Option 2 (Do Minimum) is considered to have some disadvantages over other options as climate change effects will continue on existing social and recreational facilities (i.e. beach amenity areas) in this CCA.
Integration	Compatibility with Development Plans		Do Nothing would provide a significant disadvantage over other options as development/local area plans identify coastal zone management and protection of coastal area is important. Wicklow County Council have a number of Development Plan objectives relating to coastal defence/protection.		Do Minimum would provide some disadvantages over other options as coastal zone management and coastal area protection are identified as important within the relevant development plans. The disadvantage relating to this option is that the minimum works rely on repairs and it would not fully achieve the objectives of the plans. 'Patching up' existing infra and not addressing long term climate issues doesn't address this.
	Compatibility with Climate Adaptation Plans		Do Nothing would provide significant disadvantages over other options as it would contravene climate objectives such as Eastern and Midlands Region RSES "RPO 7.3 EMRA will support the use of Integrated Coastal Zone Management (ICZM) to enable collaborative and stakeholder engagement approaches to the management and protection of coastal resources against coastal erosion, flooding and other threats."		Do Minimum would provide some disadvantages over other options as coastal zone management and coastal area protection are identified as important within the relevant development plans. The disadvantage relating to this option is that the minimum works rely on repairs, not a full upgrade would not fully achieve the objectives of the plans which include the need for climate adaptation. The Climate Action Plan 2023 sets out under 15.3.6 (Adaptation) the challenges related to the operation and resilience of the inter alia the rail network. There is a need to go beyond 'patching up' and to prepare for current and future change.
	Compatibility with Transport Plans		The NTA's Greater Dublin Area Transport Strategy 2022-2042 outlines the need to ensure resiliency of the public transport network to climate change effects, and specifically mentions potential flooding along the Dublin and Wicklow coastline. Do Nothing will mean no interventions being made to prevent flooding and coastal erosion, events of which may become increasingly more frequent in the future due to climate change. While there may be little short-term impact, in the longer term this will put increasing pressure on the public transport to accommodate passengers displaced from rail services. Disruptions to the rail service may result in an unreliable public transport system, causing a mode shift to car travel rather than public transport. This goes against the Transport Strategy's focus on facilitating increased use of sustainable modes.		Do Minimum is expected to involve disruptions to public transport in the short to medium term to conduct repairs as the need arises. The ad hoc repairs will address damage that may occur, but won't build longer-term resilience against potential impacts of flooding or erosion. As per Do Nothing, this is likely to put increasing pressure on the public transport system and challenge its reliability, going against the Transport Strategy's focus on facilitating increased use of sustainable modes.
	Biodiversity		Do Nothing would provide an advantage in the short to medium term as there would be no construction work and therefore no impact on biodiversity/protected areas from habitat loss/degradation and disturbance (noise/pollution). There are no Ramsar sites, there is one SAC (The Murrough SAC), one SPA (The Murrough SPA) and one pNHA (The Murrough pNHA) within CCA6.2 that could be effected in a beneficial way in the short to medium term. Natural processes would not be constrained and European and Nationally designated habitats and species would not be impacted by construction or operational effects. In the long term there could be loss of habitats through erosion and exposure of the wetlands to tidal action. There is also the potential for pollution from oils etc. embedded in existing rail line contaminating the shore and sea.		Do Minimum would provide a slight disadvantage in comparison to the 'Do Nothing' option as there would be little/limited/targeted construction work and therefore minimal impact on biodiversity/protected areas in the short to medium term. There are no Ramsar sites, there is one SAC (The Murrough SAC), one SPA (The Murrough SPA) and one pNHA (The Murrough pNHA) within CCA6.1 and repair works could cause disturbance to QI bird species and habitats for example. If unhindered, the natural process of habitat expansion will provide supporting habitat for SPA bird species of The Murrough SPA and foraging for breeding little tern. Limited impacts to QI species from construction are through impacts to habitats from habitat degradation and disturbance to birds and seals (QI of Lambay Island SAC) from noise.

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Enviroment	Landscape and Visual and Seascape		Continued degradation and coastal erosion as a result of no works being undertaken would result in significant deterioration and change of tracts of inland coastal landscape designated for their outstanding natural beauty. Notable potential to generate significant adverse landscape/seascape and visual effects. Significant disadvantages over all 'Do Minimum' options.		Continued reactive interventions would compromise the character and quality of this stretch of coastline, with ongoing works generating adverse landscape/seascape and visual effects. Given the scale of this section of coastline, this ongoing state of repair and disruption is comparatively less impactful than in other parts of the coastline. Similar but with advantages over 'Do Nothing', and 'Do Minimum' options 6 and 7 as a result of being less visually impactful. Disadvantages over options 4, 5 and 8.
	Archaeology, Architectural and Cultural Heritage		Continued degradation and coastal flooding as a result of no works being undertaken would generate significant adverse Archaeology, Architectural and Cultural Heritage effects. Similar to, with disadvantages over Option 2 and significant disadvantages over all 'Do Minimum' options.		Continued degradation, and piecemeal, reactive interventions, would generate a coastline that is in a constant state of repair and disruption, with constant adverse Archaeology, Architectural and Cultural Heritage effects. Similar to, with advantages over option 1. Some disadvantages over 'Do Minimum' options 4-8
	Marine Archaeology		Do Nothing would provide some advantage as there would be no proposed construction and therefore no potential impact on archaeological features in the intertidal and marine elements.		Do Minimum would provide some advantage as there would be limited/targeted construction and therefore no potential impact on archaeological features in the intertidal and marine elements.
	Noise and Vibration		Do Nothing would provide some advantages as there would be no construction or maintenance works and therefore no construction related noise or vibration impacts on noise sensitive population receptors. The long term operational scenario would have some disadvantages compared to other options if rail services are suspended and road traffic on surrounding road network increases. Due to the longer term duration of potential impacts, this is weighted as less advantageous over other options		Do Minimum would provide some advantages due to absence of temporary - short term noise and vibration impacts from any construction works. The existing maintenance works will continue as necessary which will be of neutral impact, albeit these will likely intensify in frequency. The long term operational scenario is neutral compared to other options, although the rail service will likely be less reliable and has potential for increased traffic on surrounding road network. Due to the longer term duration of potential impacts, this is weighted as less advantageous over other options
	Air Quality		No construction phase impacts. Potential for long term local operational phase impacts should the rail line be suspended in future. If rail services are suspended this has the potential to increase local road traffic.		Lower or not significant construction phase impacts. General construction dust emissions and heavy Machinery have the potential to be used for reactive Do Minimum construction works, resulting sources of dust and air pollution. Potential for long term local operational phase impacts should the rail line be suspended in future. If rail services are suspended this has the potential to increase local road traffic.
	Carbon Management		GHG emissions from embodied carbon is lower due to no construction. However, the potential for long term local operational phase impacts should the rail line be suspended in future. If rail services are suspended this has the potential to increase local road traffic.		GHG emissions from embodied carbon is minimised lower due to no construction. General construction works and heavy Machinery used to implement beach nourishment and dune regeneration are sources of dust and air pollution. However, the potential for long term local operational phase impacts should the rail line be suspended in future. If rail services are suspended this has the potential to increase local road traffic.
	Water Resources		Do Nothing would provide a significant advantage as it there would be no construction work and therefore no impact on groundwater		This Option is similar to other options as there should be minimal impacts on groundwater
	Geology and Soils		In the short term, there will be no significant impacts to geological resources. However, the effects of climate change may result in the erosion of the local geology in the medium to long term.		There will be some advantages in the short term as a result of the minimal disturbance during the construction phase of the scheme. However, the mitigation installed may not be sufficient to address erosion of geological resources caused by climate change. Similar to Options 6 and 7.
	Material and Circular Economy		Do Nothing would provide significant advantages over other options as it avoids the consumption and use of material resources. However, some materials would still be consumed in managing the HSE risks of the structures failing (e.g. signage or fencing to prevent access).		Do Minimum would provide significant advantages over other options as it minimises the consumption and use of material resources through maximising the use of existing assets to reduce the extent of any new construction required (i.e. during the current maintenance regime of ongoing monitoring and reactive repairs).
	Waste		Do Nothing would provide significant advantages over other options as it avoids the generation and disposal of waste. However, waste is still likely to be generated during any future works involved with managing the HSE risks of the structures failing (e.g. targeted removal of existing site assets).		Do Minimum would provide significant advantages over other options as it minimises the generation and disposal of waste through maximising the use of existing assets to reduce the extent of any new construction required (i.e. during the current maintenance regime of ongoing monitoring and reactive repairs).
Traffic and Transport		Potential for significant disruption to transport in the longer term if no intervention is made. As the road network is further inland than the rail line in this CCA, rail service impacts would leave passengers with limited alternative travel options, leading to increased congestion on the wider road network and possible overcrowding on buses.		Potential unexpected disruptions to transport to make ad hoc repairs. As the road network is further inland than the rail line in this CCA, rail service impacts would leave passengers with limited alternative travel options, leading to increased congestion on the wider road network and possible overcrowding on buses.	

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Engineering/ Technical	Constructability		Do Nothing requires no construction works (other than making the area safe)		This Option is likely to require ad hoc emergency repairs to the wall alongside the railway. Localised emergency works may also be required after significant weather events.
	Rail Service Impact		Do Nothing requires no construction works (other than making the area safe)		This Option is likely to require ad hoc and emergency works to the wall alongside the railway, which may impact rail operations. It will be difficult to plan ahead for these works as there will be no strategy in place for routine maintenance works.
	Reliance on Maintenance Maintenance burden		No requirement for maintenance but significant monitoring would be required to keep the public safe.		This Option would rely heavily on monitoring and maintenance.
	Adaptation		No opportunity for adaptation.		Minimal opportunities for adaptation
	Residual Risk		Defence will likely slowly degrade and would then fail very quickly/catastrophically during an event.		This Option would not eliminate weaknesses in the existing hard defence, which could lead to rapid failure.
Planning Risk	Consenting Risk		Do Nothing would provide a significant advantage as it would require no consents.		Do Minimum would provide a significant advantage as it would require no consents.

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Core Criteria	Sub Criteria	Option 4	Option 4 Narrative (Rock Revetments with wave wall where needed)	Option 5	Option 5 Narrative (Concrete Armour Unit Revetment)
Economy	Land Use and Third Party Assets		This Option has significant disadvantages as there would be impacts on third party land-owners with potential CPO required.		This Option has significant disadvantages as there would be impacts on third party land-owners with potential CPO required.
	Capital Expenditure		This Option has significant advantages over other options as all construction could be land based. It is assumed that the rock would be delivered from overseas by barge and stockpiled directly onto the beach (depending on vessel draught it may come in smaller or larger barges depending on the contractors methodology).		This Option has disadvantages as the concrete armour units would need to be fabricated 'on-site', most likely on the quayside and then transported to the workface via flat top barges. Heavy marine plant would be needed to handle them and also sizeable mobile cranes landside. Specialist contractors and skillsets would be needed to install them. The concrete units would be fabricated under a sub license contract from the armour unit designers increasing cost and stakeholders to the project. In addition to the concrete armour unit a significant amount of rock armour would still be needed for the underlayers which would also need to be transported by barge.
	Maintenance Expenditure		Operational maintenance costs for this option should be relatively low. Some maintenance in the form of repositioning rocks may be required within the design life but this should be infrequent. Repair works could be undertaken from the beach with excavators mitigating the need for specialist or marine based plant.		The maintenance costs for this option would be slightly higher than for Option 4. Although maintenance should be infrequent, maintenance of the concrete armour unit revetments would be more complex and therefore more expensive than the rock revetments.
Safety	Health and Safety (Construction)		This Option has significant advantages over other options as the rock armour can be handled exclusively by proprietary marine equipment and should not require land based handling and transportation. The revetment will be constructed by land based equipment although some marine works will be required to transport the rock to the workface. The construction of rock revetments is also less complex than detached breakwaters and concrete structures.		This Option would have significant risk in comparison to Option 4 due to the transportation and handling of heavy concrete armour units both on land and by marine. Most of the works would be marine based and require large equipment to transport, handle and place heavy concrete armour units and rock armour. Marine works in open water are subject to increased weather risk which could impact productivity and is a programme risk.
	Health and Safety (Design Life)		This Option has advantages over other options as the potential Health and Safety risks posed by this option can be more easily managed. This Option could pose some Health and Safety risks of people climbing on the rock revetments and becoming trapped. Warning signs should be installed to mitigate this. The revetments will significantly reduce the useable area of the beach in which could lead to people becoming trapped by the tides. This can be mitigated through increased access points through the revetments.		This Option is very similar to Option 4. The concrete armour unit revetments will result in very similar Health and Safety risks as the rock revetments.
Accessibility and Social Inclusion	Community		This Option is considered to have disadvantages to other options as it would place a rock revetment along the entire coastline, which would likely have a detrimental effect on the local community. This is because the rock revetment would be placed along the length and breadth of the existing beach area, restricting its use and general amenity value for the local community. This Option is likely to be less attractive to the public than other options.		This Option is considered to have disadvantages to other options as it would place concrete armour revetment along the entire coastline, which would likely have a detrimental effect on the local community. This is because the concrete armour revetment would be placed along the length and breadth of the existing beach area, restricting its use and general amenity value for the local community. This Option is likely to be less attractive to the public than other options.
	Access		This Option is considered to have some disadvantages to other options as while there will be the imposition of rock revetments along the entirety of this CCA, access steps will be incorporated into the revetment to ensure any formal/informal access points to the beach amenity that currently exist and used by members of the public are maintained but access along the beach will be restricted		This Option is considered to have some disadvantages to other options as while there will be the imposition of revetments along the entirety of this CCA, access steps will be incorporated into the revetment to ensure any formal/informal access points to the beach amenity that currently exist and used by members of the public are maintained but access along the beach will be restricted

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	Social and Recreation Facilities		This Option is considered to have some disadvantages over other options as rock revetments will be placed along the majority of the coastline within this CCA, which will likely limit or remove the use of the beach amenity area for recreational purposes.		This Option is considered to have some disadvantages over other options as concrete armour revetments will be placed along the majority of the coastline within this CCA, which will likely limit or remove the use of the beach amenity area for recreational purposes.
Integration	Compatibility with Development Plans		This Option is similar to other options as it aligns with high level coastal protection and coastal area management objectives within the development plan. However, there is no enhancement of the areas, it does not utilise naturally occurring green infrastructure, is likely to impact upon natural habitats, involves large amount of hard standing and does not provide coastal recreation amenities or incorporate pedestrian/cycling infrastructure. The Wicklow County Council Dev Plan Cell 6 (Kilcoole - Wicklow Town) is dominated by The Murrough cSAC, which occupies 25% of the area. The Murrough is a coastal wetland complex, which stretches for 15km from Ballygannon to north of Wicklow town, and in parts, extends inland for up to 1km (The Murrough is also a pNHA). A shingle ridge stretches the length of the site. The site supports a number of habitats listed on Annex I of the EU Habitats Directive and a number of bird species listed on Annex I of the EU Birds Directive, as well as a wide range of important migratory birds. There are also many rare plants in the site. Has specific objectives including 'No development will be permitted that has an adverse impact on the environmental and ecological quality of The Murrough cSAC. The Planning Authority will have particular regard to the impact that all developments have on the integrity of the cSAC, including development that is within the cSAC and development that is not within a designated area, but which is likely to have an effect thereon.' and 'To facilitate the development of a coastal walk (having due regard to environmental designations and compliance with the EU Habitats Directive) and to restrict development that interferes with the achievement of this objective.' and 'To protect all listed views and prospects along the R761 and coast in this cell.' and 'To facilitate coastal protection works (natural, soft and hard engineered), to protect both the amenity and ecological value of the coastline and the significant economic and social value of the railway line.' The southern-most section of the study area also appears to be within Cell 7: Wicklow Town which seeks "To support the coastal protection and development objectives of the relevant Local (Area) Plan for Wicklow Town - Rathnew." It also states "No development will be permitted that has the potential to adversely affect the conservation objectives of the Murrough Wetlands SAC, The Murrough SPA, Wicklow Head SAC, or Wicklow Reef SPA either directly, indirectly or cumulatively." It further states "To facilitate the development and enhancement of visitor and recreational facilities along the coastal area, particularly walking routes, car parking areas, signage, changing/toilet facilities and water based clubs." It also states "To facilitate coastal protection works (natural, soft and hard engineered), to protect both the amenity and ecological value of the coastline and the significant economic and social value of the railway line." Within zonings, Conservation Zone, cSPA, pNHA, SAC, public right of way and listed views. Note Wicklow Town Local Area Plan 2019 Conservation Area which appears to cover the southern tip of the study area.		This Option is very similar to Option 4
	Compatibility with Climate Adaptation Plans		This Option would have advantages to other options as it would align with the Transport Climate Change Sectoral Adaptation Plan (Transport Climate Change Sectoral Adaptation Plan) by protecting the existing rail infrastructure through a complete upgrade of existing defences. However, it would also involve a significant volume of materials for the rock revetments to be brought to site and transport of same. No concrete will be required however.		This Option is similar to other options as it would align with the Transport Climate Change Sectoral Adaptation Plan (Transport Climate Change Sectoral Adaptation Plan) by protecting the existing rail infrastructure through a complete upgrade of existing defences. However, it would also involve a significant volume of materials for the rock revetments to be brought to site and transport of same.
	Compatibility with Transport Plans		This Option will improve the protection of the rail line against climate change impacts, in line with the Transport Strategy's aim to "provide a sustainable, accessible and effective transport system for the Greater Dublin Area which meets the region's climate change requirements, serves the needs of urban and rural communities, and supports economic growth". The Greater Dublin Area Cycle Network Plan proposes a National Cycle Route, the East Coast Trail, with an indicative route along part of the coastline between Greystones and Wicklow Town. Providing the intervention works can accommodate the East Coast Trail, this option will support the Transport Strategy.		This Option will improve the protection of the rail line against climate change impacts, in line with the Transport Strategy's aim to "provide a sustainable, accessible and effective transport system for the Greater Dublin Area which meets the region's climate change requirements, serves the needs of urban and rural communities, and supports economic growth". The Greater Dublin Area Cycle Network Plan proposes a National Cycle Route, the East Coast Trail, with an indicative route along part of the coastline between Greystones and Wicklow Town. Providing the intervention works can accommodate the East Coast Trail, this option will support the Transport Strategy.
	Biodiversity		This Option has disadvantages over other options as it would result in loss of QI species and habitats under the footprint of the revetment. It also has the potential for change to hydrology causing erosion from hard infrastructure on seaward side. Changes to land-ward side wetland habitats unknown and Priority habitat of Calcareous fens present in this area. A significant amount of rock armour would be needed which would need to be transported by barge. Night time works could be needed causing disturbance. There are no Ramsar sites, there is one SAC (The Murrough SAC), one SPA (The Murrough SPA) and one pNHA (The Murrough pNHA) within CCA6.2. On the seaward side of the shingle bank which runs along The Murrough Wetlands SAC site drift line vegetation and previously rare and legally protected Oyster plant (<i>Mertensia maritima</i>) (Flora (Protection) Order, 1999) has been recorded on the gravelly shore (now considered extinct). Drift lines along entire length and perennial vegetation in south and covering a notable area. Salt meadows (<i>Glauco-Puccinellietalia maritima</i>) to west of rail in line in and around Broadlough Estuary. Areas of 80-100 cover in proximity to west of rail line. Mediterranean salt meadows (<i>Juncetalia maritima</i>) with similar distribution to (<i>Glauco-Puccinellietalia maritima</i>) to west of rail in line in and around Broadlough Estuary. Priority habitat at south of CCA. At the southern end of the site, Broad Lough, a brackish, partly tidal lake, has a well-developed saltmarsh community. Light-bellied Brent Goose occurs here in internationally important numbers. Nationally important for Red-throated Diver, Greylag Goose, Wigeon, Teal, Black-headed Gull and Herring Gull. It is probably the most important site in the country for nesting Little Tern and nesting area runs along the entire stretch of the shore line. Seal (QI of Lambay Island SAC) haul out here. Construction effects include disturbance to QI species and habitat degradation.		This Option has disadvantages over other options as it would result in loss of QI species and habitats under the footprint of the revetment. It also has the potential for change to hydrology causing erosion from hard infrastructure on seaward side. Changes to land-ward side wetland habitats unknown and Priority habitat of Calcareous fens present in this area. A significant amount of rock armour would be needed (for the underlayers) which would need to be transported by barge. Night time works could be needed causing disturbance. There are no Ramsar sites, there is one SAC (The Murrough SAC), one SPA (The Murrough SPA) and one pNHA (The Murrough pNHA) within CCA6.2. On the seaward side of the shingle bank which runs along The Murrough Wetlands SAC site drift line vegetation and previously rare and legally protected Oyster plant (<i>Mertensia maritima</i>) (Flora (Protection) Order, 1999) has been recorded on the gravelly shore (now considered extinct). Drift lines along entire length and perennial vegetation in south and covering a notable area. Salt meadows (<i>Glauco-Puccinellietalia maritima</i>) to west of rail in line in and around Broadlough Estuary. Areas of 80-100 cover in proximity to west of rail line. Mediterranean salt meadows (<i>Juncetalia maritima</i>) with similar distribution to (<i>Glauco-Puccinellietalia maritima</i>) to west of rail in line in and around Broadlough Estuary. Priority habitat at south of CCA. At the southern end of the site, Broad Lough, a brackish, partly tidal lake, has a well-developed saltmarsh community. Light-bellied Brent Goose occurs here in internationally important numbers. Nationally important for Red-throated Diver, Greylag Goose, Wigeon, Teal, Black-headed Gull and Herring Gull. It is probably the most important site in the country for nesting Little Tern and nesting area runs along the entire stretch of the shore line. Seal (QI of Lambay Island SAC) haul out here. Construction effects include disturbance to QI species and habitat degradation.

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Enviroment	Landscape and Visual and Seascape		As a natural material, rock revetements would tie in comparatively successfully with the natural qualities of this long stretch of coastline that is already influenced by existing rock revetements and the shingle beach material. The placement of material would be more robust and considered than reactionary measures, and as such would complement and enhance those rock revetements already present. When used consistently, the continuous feature will have a scale and uniformity that will complement its large sweeping nature, moderating landscape and visual effects. In places they require a large land take, which will result in the loss of a large areas of beach which is considered adverse.		Whilst used consistently (of benefit in terms of the perceived uniformity of character along this long stretch of coastline), the use of concrete units is considered inappropriate and incongruous with its designated natural and scenic qualities, and with notable potential to generate significant adverse landscape/seascape and visual effects. It would however have advantages over options that involve conspicuous offshore elements.
	Archaeology, Architectural and Cultural Heritage		A potential direct impact on one SMR Zone of Notification associated with W1019-038; Prehistoric site - lithic scatter has been identified, there is also the potential for direct impacts to occur on previously unrecorded archaeological heritage. There is the potential for significant indirect setting and visual impacts to occur on one SMR site W1019-038; Prehistoric site - lithic scatter and the associated Zone of Notification. There is also the potential for indirect setting and visual impacts to occur on two further SMR sites (W125-013; Castle - Anglo-Norman masonry castle and W1025-012012; Promontory fort - coastal). There is the potential for indirect setting and visual impacts to occur on 3 NIAH Sites one of which is also an RPS site (16401912; Station master's house (RPS ref 13-38), 16005001; lighthouse, 16004154; pier/jetty). There is the potential for indirect setting and visual impacts to occur on one further RPS site (RPS ref 19-12; coastguard cottages). There is also the potential for significant direct impacts to occur on previously unrecorded material culture. Significant advantages over Options 1 and 2.		A potential direct impact on one SMR Zone of Notification associated with W1019-038; Prehistoric site - lithic scatter has been identified, there is also the potential for direct impacts to occur on previously unrecorded archaeological heritage. There is the potential for significant indirect setting and visual impacts to occur on one SMR site W1019-038; Prehistoric site - lithic scatter and the associated Zone of Notification. There is also the potential for indirect setting and visual impacts to occur on two further SMR sites (W125-013; Castle - Anglo-Norman masonry castle and W1025-012012; Promontory fort - coastal). There is the potential for indirect setting and visual impacts to occur on 3 NIAH Sites one of which is also an RPS site (16401912; Station master's house (RPS ref 13-38), 16005001; lighthouse, 16004154; pier/jetty). There is the potential for indirect setting and visual impacts to occur on one further RPS site (RPS ref 19-12; coastguard cottages). There is also the potential for significant direct impacts to occur on previously unrecorded material culture. Significant advantages over Options 1 and 2.
	Marine Archaeology		There are 2 known wrecks; W02313, W18550 and 1 recorded loss W10651 located in this section. There are no direct impacts on previously unrecorded wrecks, paleoenvironmental landscapes and material culture, and therefore no potential impact on archaeological features in the intertidal and marine elements.		There are 2 known wrecks; W02313, W18550 and 1 recorded loss W10651 located in this section. There are no direct impacts on previously unrecorded wrecks, paleoenvironmental landscapes and material culture, and therefore no potential impact on archaeological features in the intertidal and marine elements.
	Noise and Vibration		Noise impact will be from mobile plant when working in proximity to population Noise Sensitive Locations. Very low density of population Noise Sensitive Locations along full length. Specific instances of elevated noise will be localised and temporary when working close to Noise Sensitive Locations. There will be periods of night-time works required to work around tides. No significant vibration impacts from this proposal. All impacts are temporary to short-term. No long term operational noise or vibration impacts.		Noise impact will be from mobile plant when working in proximity to population Noise Sensitive Locations. Very low density of population Noise Sensitive Locations along full length. Specific instances of elevated noise will be localised and temporary when working close to Noise Sensitive Locations. There will be periods of night-time works required to work around tides. No significant vibration impacts from this proposal. All impacts are temporary to short-term. No long term operational noise or vibration impacts.
	Air Quality		No operational phase impacts, with the assumption that maintenance requirement is very low hence some advantages. Potential for construction phase impacts associated with potentially dusty activities and construction vehicle emissions. Construction phase impacts would be likely considered short term and dust mitigation can be put in place. Some advantages in options 4, 5 and 8 over options due to no beach nourishment maintenance required. This Option would facilitate operational phase reliance on public transport and reduce reliance on private vehicles for the long term.		No operational phase impacts, with the assumption that maintenance requirement is very low hence some advantages. Potential for construction phase impacts associated with potentially dusty activities and construction vehicle emissions. Construction phase impacts would be likely considered short term and dust mitigation can be put in place. Some advantages in options 4, 5 and 8 over options due to no beach nourishment maintenance required. This Option would facilitate operational phase reliance on public transport and reduce reliance on private vehicles for the long term.
	Carbon Management		Whole Life Carbon (tonnes CO2e) was 234% of average across the 7 options, therefore it is the least preferable of the options. This Option would facilitate operational phase reliance on public transport and reduce reliance on private vehicles for the long term.		Whole Life Carbon (tonnes CO2e) was 155% of average across 7 options, therefore it is of less preferable to other options. This Option would facilitate operational phase reliance on public transport and reduce reliance on private vehicles for the long term.
	Water Resources		This Option is similar to other options as there should be minimal impacts on groundwater		This Option is similar to other options as there should be minimal impacts on groundwater
	Geology and Soils		Rock revetment and wave walls are anticipated to cause minimal disturbance to geological resources throughout CCA6.2. There is also potential that excavations in the vicinity of historic and current contaminative land features (e.g., former gas works, infilled pits, military facilities, industrial land uses, etc.) could result in the remobilisation of associated contamination.		Concrete armour unit revetment and wave walls are anticipated to cause minimal disturbance to geological resources throughout CCA6.2. There is also potential that excavations in the vicinity of historic and current contaminative land features (e.g., former gas works, infilled pits, military facilities, industrial land uses, etc.) could result in the remobilisation of associated contamination.
	Material and Circular Economy		This Option would provide some advantages over other options due to its comparatively low materials consumption score (1,070,563t).		This Option would provide some advantages over other options due to its comparatively low materials consumption score (1,228,228t).
	Waste		This Option would be similar to options 6 and 7. Minimal waste would be generated from the removal of existing structures (any existing rock will be reused in the new defences). In addition, this option is likely to be associated with comparatively low wastage (661t). Wastage from damaged materials has been estimated based on the application of material-specific wastage rates to the quantities of concrete materials that are likely to be used in constructing the option.		This Option would provide some disadvantages over other options. Minimal waste would be generated from the removal of existing structures (any existing rock will be reused in the new defences). In addition, this option his likely to be associated with comparatively high wastage (19,419t).
	Traffic and Transport		Minimal operational impact expected to traffic and transport; the intervention works will be localised to the coast and are not anticipated to affect transport systems or travel demand.		Minimal operational impact expected to traffic and transport; the intervention works will be localised to the coast and are not anticipated to affect transport systems or travel demand.

CCA6.2 Emerging Preferred Option Multi Criteria Analysis

Core Criteria	Sub Criteria	Option 4	Option 4 Narrative (Rock Revetments with wave wall where needed)	Option 5	Option 5 Narrative (Concrete Armour Unit Revetment)
Engineering/ Technical	Constructability		This Option has advantages over other options as although it requires significant volumes of rock armour the construction is relatively simple but would be slow due to the scale of the works. Several work fronts could be opened up to improve construction duration. It is assumed that rock armour will be delivered by marine plant.		This Option would be challenging to construct. Production, handling and placing of concrete armour units would need to be facilitated from land, increasing onshore footprint of the project. Placing of concrete armour units can be challenging. Depending on the size/weight of the units and will require specialist plant and experience in placing. Interlocking of units is required and replacement of broken units is difficult, especially at or near the toe.
	Rail Service Impact		Minimal impact on operation of railway line. Irish Rail will require to be notified of works as adjacent to the railway line but this is expected to be low risk.		Minimal impact on operation of railway line. Irish Rail will require to be notified of works as adjacent to the railway line but this is expected to be low risk.
	Reliance on Maintenance Maintenance burden		This Option has significant advantages over other options as the revetments only require routine and post storm monitoring but should require minimal maintenance during the design life. This Option is a hard defence and would be designed to accommodate future lowering of beach levels and climate change. Therefore maintenance of the beach would be less important.		This Option has significant advantages over other options as the revetments only require routine and post storm monitoring but should require minimal maintenance during the design life. This Option is a hard defence and would be designed to accommodate future lowering of beach levels and climate change. Therefore maintenance of the beach would be less important.
	Adaptation		This Option would be designed to account for predicted climate change. Changes to the beach levels to account for any additional changes could be undertaken but changes to the hard defences would be challenging		This Option has disadvantages compared to Option 4 because changes to a concrete armour unit revetment would be more challenging than a rock revetment due to the need for bespoke made armour units and the interlocking nature of the units
	Residual Risk		This Option would use new hard engineering to manage risk, with less reliance on a beach (which could be stripped out quickly in a significant event). If the new defence was compromised, failure could be rapid.		This Option would use new hard engineering to manage risk, with less reliance on a beach (which could be stripped out quickly in a significant event). If the new defence was compromised, failure could be rapid.
Planning Risk	Consenting Risk		A full upgrade of existing defences would protect the area for a longer time in line with planning policy Works are carried out in Natura 2000 site with potential for temporary and permanent impacts on qualifying interests which could invoke IROPI. Works will likely require a Maritime Area Consent.		A full upgrade of existing defences would protect the area for a longer time in line with planning policy Works are carried out in Natura 2000 site with potential for temporary and permanent impacts on qualifying interests which could invoke IROPI. Works will likely require a Maritime Area Consent. Less concrete/hard standing generally along the length of the coastline may be more preferable to potential third party objectors on comparison with options that have more a prominent degree of hard standing.

CCA6.2 Emerging Preferred Option Multi Criteria Analysis

Core Criteria	Sub Criteria	Option 6	Option 6 Narrative (Detached breakwaters with beach nourishment and concrete splash wall where required)	Option 7	Option 7 Narrative (Detached breakwaters with beach nourishment along unprotected areas and upgrade existing revetments (new revetment in section of CCA6.2-A))
Economy	Land Use and Third Party Assets		This Option has significant disadvantages as there would be impacts on third party land-owners with potential CPO required.		This Option has significant disadvantages as there would be impacts on third party land-owners with potential CPO required.
	Capital Expenditure		This Option has significant disadvantages over other options due to the significant amount of marine based construction that would be required to construct the detached breakwaters. In addition, this option requires a significant volume of beach nourishment material which would need to be dredged and pumped ashore which would further increase the costs of this option		This Option has disadvantages compared to Option 4 as it is likely to require a similar quantity of rock armour but a significant amount of the rock armour would be required for the detached breakwaters which would require marine plant for placement. In addition, this option also requires beach nourishment.
	Maintenance Expenditure		This Option is expected to have the highest maintenance costs. The detached breakwaters should only require occasional maintenance (if any) throughout the design life but if maintenance is required this would require marine based plant which would be significantly more expensive than the land based plant required for the revetments. Frequent monitoring and regular maintenance of the nourished beaches would be required. This would use land based plant to reposition the beach material		This Option is expected to have higher maintenance costs than Option 4 due to the requirement to monitor and maintain the beach and potential higher maintenance costs of the detached breakwaters. It has advantages over Option 6 as there is less beach and less detached breakwaters to maintain, therefore reducing the costs associated with these.
Safety	Health and Safety (Construction)		This Option includes offshore breakwaters which may be challenging to construct in open water and would require the exclusive use of marine equipment to construct and carry increased safety risks. Beach nourishment would require specialist marine equipment, however this would be considered as a low safety risk.		This Option is similar to Option 6 but with some advantages as it requires less detached breakwaters which are challenging to construct.
	Health and Safety (Design Life)		This Option has advantages over other options as the breakwaters will lead to a build up of the beach material creating larger wider beaches. This will improve access along the beach and reduce the changes of people being cut off by the tide. Warning signs should be installed to deter people from accessing the breakwaters. The breakwaters could also lead to changes in currents and swimming conditions in the area. The renourished beaches may require reprofiling or renourishing during the design life which will require plant on the beach which would need to be managed to mitigate Health and Safety risks with the public.		This Option has disadvantages over Options 4 to 6 as it combines the risks associated with these options
Accessibility and Social Inclusion	Community		This Option is considered to have significant advantages over other options as it would provide an enhanced beach amenity area for the local community all along the coast. This would contribute positively to the amenity value of the area as well as the general public perception of the area.		This Option is considered to have some advantages over other options as it would provide an enhanced beach amenity area for the local community along the majority of the coast. This would contribute positively to the amenity value of the area as well as the general public perception of the area. Rock revetments are also proposed along part of this CCA as part of this option, which will likely limit any benefits of this option to the local community.
	Access		This Option is considered to have significant advantages over other options as it (for the most part) does not remove/curtail any formal or informal existing access points to the beach amenity area along its length and should improve access along the beach due to the increased size of beaches. Locations of proposed concrete splash walls are expected to be limited and therefore impacts on existing informal or formal points of access are also expected to be limited.		This Option is considered to have some disadvantages over other options as while there will be the imposition of rock revetment (and concrete splash walls where necessary) along a considerable stretch of the coastline of this CCA, access steps will be incorporated into these revetments to ensure any formal/informal access points to the beach amenity that currently exist and used by members of the public are maintained. Beach nourishment is not likely to have any impact on existing informal or formal accesses within the vicinity in which it is proposed. Locations of proposed concrete splash walls are expected to be limited and therefore impacts on existing informal or formal points of access are also expected to be limited.

CCA6.2 Emerging Preferred Option Multi Criteria Analysis

Core Criteria	Sub Criteria	Option 6	Option 6 Narrative (Detached breakwaters with beach nourishment and concrete splash wall where required)	Option 7	Option 7 Narrative (Detached breakwaters with beach nourishment along unprotected areas and upgrade existing revetments (new revetment in section of CCA6.2-A))
	Social and Recreation Facilities		This Option is considered to have significant advantages over other options as it provides additional and improved beach amenity areas all along the coastline of this CCA. However, this option also has disadvantages as the imposition of breakwaters may result in the creation of difficult and safe conditions for water-based recreational activities, such as swimming, sailing, etc.		This Option is considered to have some advantages over other options as it would provide for enhanced beach amenity areas along the majority of the coastline of this CCA, which would improve the environment for shore-based recreational activities. However, the placement of breakwaters may result in the creation of difficult and safe conditions for water-based recreational activities, such as swimming, sailing, etc. This Option has further disadvantages as the placement of rock revetment will likely remove or limit the recreational use of the northern-most section of the coastline within this CCA.
Integration	Compatibility with Development Plans		This Option would have some disadvantages over other options. It would impact on Marine Policy /Map based objectives such as cSPA, pNHA, SAC Advantage includes: enhancement of the area with beach amenity and coastal recreation amenity, elements of green infrastructure. This Option appears to require much less concrete than other options. Prospects appear to be retained from the DART line which options 4 and 5 don't facilitate. Significant amount of risk required for breakwaters and sand for beach nourishment.		This Option is similar to other options (Options 6 and 4/5) It would impact on Marine Policy /Map based objectives such as cSPA, pNHA, SAC Advantage includes: enhancement of the area with beach amenity and coastal recreation amenity, elements of green infrastructure. However volumes of concrete required for revetment upgrades. Prospects may be impacted.
	Compatibility with Climate Adaptation Plans		This Option has some disadvantages than other options. It generally aligns with Transport Climate Change Sectoral Adaptation Plan in terms of protecting the coastline and transport assets. However, it has potentially negative marine based impacts. Requires a significant volumes of rock to be transported offshore for the breakwaters. Requires significant volume of sand for beach nourishment to be transported to site. This Option uses less concrete than other options and therefore has scored higher.		This Option has some disadvantages over other options. It generally aligns with Transport Climate Change Sectoral Adaptation Plan in terms of protecting the coastline and transport assets. However, it has potentially negative marine based impacts. Requires significant volumes of rock to be transported offshore for the breakwaters. Requires significant volumes of sand for beach nourishment to be transported to site. However, it appears to have less concrete than other options such as 4/5. This Option uses less concrete than other options and therefore scores higher.
	Compatibility with Transport Plans		This Option will improve the protection of the rail line against climate change impacts, in line with the Transport Strategy's aim to "provide a sustainable, accessible and effective transport system for the Greater Dublin Area which meets the region's climate change requirements, serves the needs of urban and rural communities, and supports economic growth". The Greater Dublin Area Cycle Network Plan proposes a National Cycle Route, the East Coast Trail, with an indicative route along part of the coastline between Greystones and Wicklow Town. Providing the intervention works can accommodate the East Coast Trail, this option will support the Transport Strategy.		This Option will improve the protection of the rail line against climate change impacts, in line with the Transport Strategy's aim to "provide a sustainable, accessible and effective transport system for the Greater Dublin Area which meets the region's climate change requirements, serves the needs of urban and rural communities, and supports economic growth". The Greater Dublin Area Cycle Network Plan proposes a National Cycle Route, the East Coast Trail, with an indicative route along part of the coastline between Greystones and Wicklow Town. Providing the intervention works can accommodate the East Coast Trail, this option will support the Transport Strategy.
	Biodiversity		This Option has significant disadvantages due to the loss of QI species and habitats from the beach nourishment. Presence of Annex I species (annual vegetation drift lines) known to be present would be destroyed. In a sand/shingle community the niches between substrates are quite important and 'wave deposited sediment' (or human deposited sediment in this case) can reduce seed germination, change the arrangement of wave sorted sediments and lead to burial of seeds. There would also be long term disturbance from future nourishments. Nourishment could encourage more people to larger beach areas encouraging more disturbance. Potential for change to hydrology causing erosion from breakwaters. Loss of SPA habitat under breakwaters. Changes to land-ward side wetland habitats unknown and Priority habitat of Calcareous fens present in this area. Construction effects include disturbance to QI species and habitat degradation. Short term disturbance from construction of breakwaters. There are no Ramsar sites, there is one SAC (The Murrrough SAC), one SPA (The Murrrough SPA) and one pNHA (The Murrrough pNHA) within CCA6.2. On the seaward side of the shingle bank which runs along The Murrrough Wetlands SAC site drift line vegetation and previously rare and legally protected Oyster plant (<i>Mertensia maritima</i>) (Flora (Protection) Order, 1999) has been recorded on the gravelly shore (now considered extinct). Drift lines along entire length and perennial vegetation on in south and covering a notable area. Salt meadows (<i>Glauco-Puccinellietalia maritime</i>) to west of rail in line in and around Broadlough Estuary. Areas of 80-100 cover in proximity to west of rail line. Mediterranean salt meadows (<i>Juncetalia maritime</i>) with similar distribution to (<i>Glauco-Puccinellietalia maritime</i>) to west of rail in line in and around Broadlough Estuary. Priority habitat at south of CCA at Newcastle at East Coast Nature Reserve. At the southern end of the site, Broad Lough, a brackish, partly tidal lake, has a well-developed saltmarsh community. Light-bellied Brent Goose occurs here in internationally important numbers. Nationally important for Red-throated Diver, Greylag Goose, , Black-headed Gull and Herring Gull. It is probably the most important site in the country for nesting Little Tern and nesting area runs along the entire stretch of the shore line. Seal (QI of Lambay Island SAC) haul out here.		This Option would have similar impacts to Option 6

CCA6.2 Emerging Preferred Option Multi Criteria Analysis

Core Criteria	Sub Criteria	Option 6	Option 6 Narrative (Detached breakwaters with beach nourishment and concrete splash wall where required)	Option 7	Option 7 Narrative (Detached breakwaters with beach nourishment along unprotected areas and upgrade existing revetments (new revetment in section of CCA6.2-A))
Environment	Landscape and Visual and Seascape		Beach nourishment applied consistently along the stretch of coastline has the potential to have a positive influence. However, detached breakwaters applied consistently along the length of the coastline within the local coastal waters would be conspicuous, and would generate significant adverse landscape/seascape and visual effects.		Beach nourishment has potential to enhance the character and amenity of large sections of coastline and maintain a foreshore context. However, although to a lesser extent than Option 6, detached breakwaters within the local coastal waters would be conspicuous, and would generate significant adverse landscape/seascape and visual effects. The use of stone revetment and is consistent with stone use along this coastal edge.
	Archaeology, Architectural and Cultural Heritage		A potential direct impact on one SMR Zone of Notification associated with W1019-038; Prehistoric site - lithic scatter has been identified. A potential direct impact on two wreck sites has also been identified (W02313; Aid and W18550; Unknown), there is also the potential for direct impacts to occur on previously unrecorded archaeological heritage. There is the potential for significant indirect setting and visual impacts to occur on one SMR site W1019-038; Prehistoric site - lithic scatter and the associated Zone of Notification. There is also the potential for indirect setting and visual impacts to occur on two further SMR sites (W125-013; Castle - Anglo-Norman masonry castle and W1025-012012; Promontory fort - coastal). There is the potential for significant indirect setting and visual impacts to occur on 3 NIAH Sites one of which is also an RPS site (16401912; Station master's house (RPS ref 13-38), 16005001; lighthouse, 16004154; pier/jetty). There is the potential for significant indirect setting and visual impacts to occur on one further RPS site (RPS ref 19-12; coastguard cottages). There is also the potential for significant direct impacts to occur on previously unrecorded wrecks, paleoenvironmental landscapes and material culture. Significant advantages over Options 1 and 2.		A potential direct impact on one SMR Zone of Notification associated with W1019-038; Prehistoric site - lithic scatter has been identified. A potential direct impact on two wreck sites has also been identified (W02313; Aid and W18550; Unknown), there is also the potential for direct impacts to occur on previously unrecorded archaeological heritage. There is the potential for significant indirect setting and visual impacts to occur on one SMR site W1019-038; Prehistoric site - lithic scatter and the associated Zone of Notification. There is also the potential for indirect setting and visual impacts to occur on two further SMR sites (W125-013; Castle - Anglo-Norman masonry castle and W1025-012012; Promontory fort - coastal). There is the potential for significant indirect setting and visual impacts to occur on 3 NIAH Sites one of which is also an RPS site (16401912; Station master's house (RPS ref 13-38), 16005001; lighthouse, 16004154; pier/jetty). There is the potential for significant indirect setting and visual impacts to occur on one further RPS site (RPS ref 19-12; coastguard cottages). There is also the potential for significant direct impacts to occur on previously unrecorded wrecks, paleoenvironmental landscapes and material culture. Significant advantages over Options 1 and 2.
	Marine Archaeology		There are 2 known wrecks; W02313, W18550 and 1 recorded loss W10651 located in this section. There is the potential for significant direct impacts to occur on previously unrecorded wrecks, paleoenvironmental landscapes and material culture both within the sub-tidal areas within the footprint of the breakwaters and associated construction activity; and in connection with beach nourishment with the use of plant such as dredgers and associated activities during the transfer of shingle onto the beach.		There are 2 known wrecks; W02313, W18550 and 1 recorded loss W10651 located in this section. There is the potential for significant direct impacts to occur on previously unrecorded wrecks, paleoenvironmental landscapes and material culture both within the sub-tidal areas within the footprint of the breakwaters and associated construction activity; and in connection with beach nourishment with the use of plant such as dredgers and associated activities during the transfer of shingle onto the beach (section B - C).
	Noise and Vibration		Noise impact will be from mobile plant when working in proximity to Noise Sensitive Locations. Very low density of population Noise Sensitive Locations along full length of CCA6.2 area. Specific instances of elevated noise will be localised and temporary in this area but will require more frequent works into the future for beach nourishment works. Short term from construction noise underwater during construction of breakwaters along full extent of CCA6.2		Noise impact will be from mobile plant when working in proximity to Noise Sensitive Locations. Very low density of population Noise Sensitive Locations along full length of CCA6.2 area. Specific instances of elevated noise will be localised and temporary in this area but will require more frequent works into the future for beach nourishment in CCA6.2B and C. Short term from construction noise underwater during construction of breakwaters along CCA6.2-B and C
	Air Quality		This Option would need ongoing monitoring and maintenance requirements to maintain the beach nourishment to the design levels. The maintenance has the potential for dust emissions but can be mitigated. Potential for construction phase impacts associated with potentially dusty activities such as beach nourishment having a higher potential for dust. This Option would have a potential dust impact on sensitive receptors in proximity to the works being carried out of which beach nourishment and breakwater installation use heavy Machinery to carry out. Construction phase impacts would be likely considered short term and dust mitigation can be put in place. This Option has ongoing maintenance requirement for beach nourishment therefore is of lower preference. This Option would facilitate operational phase reliance on public transport and reduce reliance on private vehicles for the long term. P		This Option would need ongoing monitoring and maintenance requirements to maintain the beach nourishment to the design levels. The maintenance has the potential for dust emissions but can be mitigated. Potential for construction phase impacts associated with potentially dusty activities such as beach nourishment having a higher potential for dust. This Option would have a potential dust impact on sensitive receptors in proximity to the works being carried out of which beach nourishment and breakwater installation use heavy Machinery to carry out. Construction phase impacts would be likely considered short term and dust mitigation can be put in place. This Option has ongoing maintenance requirement for beach nourishment therefore is of lower preference. This Option would facilitate operational phase reliance on public transport and reduce reliance on private vehicles for the long term. P
	Carbon Management		Whole Life Carbon (tonnes CO2e) was 53% of average across 7 options, therefore it is of comparable preferable to other options which are within this range. This Option would facilitate operational phase reliance on public transport and reduce reliance on private vehicles for the long term.		Whole Life Carbon (tonnes CO2e) was 51% of average across 7 options, therefore it is of comparable preferable to other options which are within this range. This Option would facilitate operational phase reliance on public transport and reduce reliance on private vehicles for the long term.
	Water Resources		This Option is similar to other options as there should be minimal impacts on groundwater		This Option is similar to other options as there should be minimal impacts on groundwater
	Geology and Soils		The adoption of beach nourishment and detached breakwater will cause moderate disturbance to geological resources and the remobilisation of contamination associated with historical and current contaminative land features through the cell. This assumes the detached breakwaters do not intercept the offshore dredged material disposal sites in CCA6.2-D. The concrete splash wall is expected to cause moderate disturbance to geological resources and localised remobilisation of ground contamination. Similar to Options 2 and 7.		Construction and upgrade of new and existing rock revetments is anticipated to cause minimal to some disturbance to geological resources in CCA6.2-A. The adoption of beach nourishment and detached breakwater will cause moderate disturbance to geological resources and areas of ground contamination in CCA6.2-B and CCA6.2-C. This assumes the detached breakwaters will not intercept the offshore disposal sites in CCA6.2-D. The concrete splash walls are expected to cause moderate disturbance to geological resources and areas of potential ground contamination. Upgrades of existing revetment in CCA6.2-D is expected to cause no to minimal disturbance to geological resources and areas of potential ground contamination. Similar to Options 2 and 6.
	Material and Circular Economy		This Option would provide significant disadvantages over other options due to its comparatively high materials consumption score (11,075,134t).		This Option would provide some disadvantages over other options due to its comparatively high materials consumption score (6,473,514t).
	Waste		This Option would be similar to options 4 and 7. Minimal waste would be generated from the removal of existing structures (where rock revetments currently exist, the majority of the rock will be reused within the new revetments). In addition, this option is likely to be associated with comparatively low wastage (297t).		This Option would be similar to options 4 and 6. Minimal waste would be generated from the removal of existing structures (where rock revetments currently exist, the majority of the rock will be reused within the new revetments). In addition, this option is likely to be associated with comparatively low wastage (388t).
Traffic and Transport		Minimal operational impact expected to traffic and transport; the intervention works will be localised to the coast and are not anticipated to affect transport systems or travel demand.		Minimal operational impact expected to traffic and transport; the intervention works will be localised to the coast and are not anticipated to affect transport systems or travel demand.	

CCA6.2 Emerging Preferred Option Multi Criteria Analysis

Core Criteria	Sub Criteria	Option 6	Option 6 Narrative (Detached breakwaters with beach nourishment and concrete splash wall where required)	Option 7	Option 7 Narrative (Detached breakwaters with beach nourishment along unprotected areas and upgrade existing revetments (new revetment in section of CCA6.2-A))
Engineering/ Technical	Constructability		Challenging to construct in open water and depending on water depth at high tide bottom dumping of material to form the core may not be possible. Will require specialist marine equipment and knowledge of building similar structures. Weather risk is higher and general risk profile for construction is higher in comparison to other options. Material may need to be stockpiled on land or marine which results in double handling increasing cost and reducing efficiency.		Challenging to construct in open water and depending on water depth at high tide bottom dumping of material to form the core may not be possible. Will require specialist marine equipment and knowledge of building similar structures. Weather risk is higher and general risk profile for construction is higher in comparison to other options. Material may need to be stockpiled on land or marine which results in double handling increasing cost and reducing efficiency. The rock revetment and beach nourishment works are considered to be relatively straight forward, however the inclusion of detached breakwaters increases the complexity of these works considerably.
	Rail Service Impact		No impact on railway during construction of the detached breakwaters. Minimal impact during beach nourishment. Some potential impact during the wall raisings		No impact on railway during construction of the detached breakwaters or rock revetments. Minimal impact during beach nourishment. Some potential impact during the wall raisings
	Reliance on Maintenance Maintenance burden		This Option has disadvantages compared to other options as it would require ongoing monitoring and maintenance requirements to maintain the beach to the design levels. The detached breakwaters should require minimal maintenance but routine inspections and post storm inspections should be undertaken.		This Option has advantages over Option 6 as the areas of beach requiring ongoing monitoring and maintenance are reduced
	Adaptation		This Option does allow for some future adaptation of the beach levels through additional beach nourishment. However, this would be limited by the height of the seawalls (beach levels could not be higher than the wall levels). Adaptation of the detached breakwaters is not practical		This Option does allow for some future adaptation of the beach levels through additional beach nourishment. However, this would be limited by the height of the seawalls (beach levels could not be higher than the wall levels). Adaptation of the detached breakwaters is not practical
	Residual Risk		Breakwaters will reduce wave energy at the shoreline, making shoreline structures less likely to fail quickly. Breakwater failure is generally slow and not catastrophic.		Breakwaters will reduce wave energy at the shoreline, making shoreline structures less likely to fail quickly. Breakwater failure is generally slow and not catastrophic.
Planning Risk	Consenting Risk		A full upgrade of existing defences would protect the area for a longer time in line with planning policy Works are carried out in Natura 2000 sites with potential to require IROPI. Potential for significant landscape and visual effects. Marine based elements require planning (Maritime Area Consent) (Foreshore Licence) (Minister Consent). This is a 'soft engineering' approach that could be more preferable to potential third party objectors. Could be less visual impacts and could be considered to 'feel' more like an amenity space and integrate more appropriately.		A full upgrade of existing defences would protect the area for a longer time in line with planning policy Works are carried out in Natura 2000 sites which may invoke IROPI. Marine based elements require planning (Maritime Area Consent) (Foreshore Licence) (Minister Consent). Less concrete/hard standing generally along the length of the coastline may be more preferable to potential third party objectors on comparison with options that have more a prominent degree of hard standing.

CCA6.2 Emerging Preferred Option Multi Criteria Analysis

Core Criteria	Sub Criteria	Option 8	Option 8 Narrative (Defer option through rock toe protection to vegetation)
Economy	Land Use and Third Party Assets		This Option has significant disadvantages as there would be impacts on third party land-owners with potential CPO required.
	Capital Expenditure		This Option has significant advantages because it requires significantly less rock volumes than other options. All construction could be land based.
	Maintenance Expenditure		This Option is considered to have the lowest maintenance costs. Maintenance of the rock revetments would be infrequent and land based. Any maintenance of the rock toe protection would also be infrequent and land based.
Safety	Health and Safety (Construction)		This Option requires works exclusively at the shoreline rather than open water. The rock toe works would be similar in nature to Option 4. The exclusive use of rock reduces the safety risk as all work could be executed by marine equipment.
	Health and Safety (Design Life)		This Option is very similar to Option 4 but the rock structures along the beach will be smaller therefore slightly reducing the risk to the public
Accessibility and Social Inclusion	Community		This Option has some advantages over other options as it provides rock revetment and rock toe protection along the majority of this coastline of this CCA. While similar to other options with the placement of rock revetment along a considerable portion of the coastline, the beach amenity area will still be available for public use where rock toe protection is proposed.
	Access		This Option is considered to have some advantages over other options as while there will be the imposition of rock revetment along a considerable stretch of the coastline of this CCA, access steps will be incorporated into these revetments to ensure any formal/informal access points to the beach amenity that currently exist and used by members of the public are maintained. Beach nourishment and rock toe protection are not likely to have any impact on existing informal or formal accesses within the vicinity in which is it proposed.

CCA6.2 Emerging Preferred Option Multi Criteria Analysis

Core Criteria	Sub Criteria	Option 8	Option 8 Narrative (Defer option through rock toe protection to vegetation)
	Social and Recreation Facilities		This Option is considered to have some advantages over other options as the placement of rock revetment along the majority of the coastline within this CCA will likely limit or remove its use for recreational purposes. However, with only rock toe protection proposed for the southern-most section of the coastline of this CCA, recreational use of the shore and water at this location will largely remain unchanged.
Integration	Compatibility with Development Plans		This Option would have some advantages. It would impact on Marine Policy /Map based objectives such as SAC, PNHA, SPA and Open Space Zoning. Within the same Wicklow County Council Cell areas 4 and 5 BUT only a very small section is within Cell 6 at Kilcoole. Advantage includes: enhancement of the area with beach amenity and coastal recreation amenity, elements of green infrastructure. This Option appears to require much less concrete and hard infrastructure area than other options. Prospects may be impacted. Generally less impacts along the length of the coastline on comparison with other options
	Compatibility with Climate Adaptation Plans		This Option has some advantages it generally aligns with Transport Climate Change Sectoral Adaptation Plan in terms of protecting the coastline and transport assets. Requires significant volume of beach nourishment to be transported to site. However, it appears to have less concrete and hard infrastructure to other options. No offshore option no rocks to be transported. Generally less material required than other options.
	Compatibility with Transport Plans		This Option will improve the protection of the rail line against climate change impacts, in line with the Transport Strategy's aim to "provide a sustainable, accessible and effective transport system for the Greater Dublin Area which meets the region's climate change requirements, serves the needs of urban and rural communities, and supports economic growth". The Greater Dublin Area Cycle Network Plan proposes a National Cycle Route, the East Coast Trail, with an indicative route along part of the coastline between Greystones and Wicklow Town. Providing the intervention works can accommodate the East Coast Trail, this option will support the Transport Strategy.
	Biodiversity		This Option has some disadvantages over other options as construction effects include disturbance to QI species and habitat degradation. Rock armour would need to be transported by barge. Night time works could be needed causing disturbance. Operational effects include loss of QI species and habitats under the footprint of the revetment. Potential for change to hydrology causing erosion from hard infrastructure on seaward side. Likely impacts somewhat reduced from toe protection as footprint smaller. Changes to land-ward side wetland habitats unknown and Priority habitat of Calcareous fens present in this area. There are no Ramsar sites, there is one SAC (The Murrrough SAC), one SPA (The Murrrough SPA) and one pNHA (The Murrrough pNHA) within CCA6.2. On the seaward side of the shingle bank which runs along The Murrrough Wetlands SAC site drift line vegetation and previously rare and legally protected Oyster plant (<i>Mertensia maritima</i>) (Flora (Protection) Order, 1999) has been recorded on the gravelly shore (now considered extinct). Drift lines along entire length and perennial vegetation on in south and covering a notable area. Salt meadows (<i>Glauco-Puccinellietalia maritima</i>) to west of rail in line in and around Broadlough Estuary. Areas of 80-100 cover in proximity to west of rail line. Mediterranean salt meadows (<i>Juncetalia maritima</i>) with similar distribution to (<i>Glauco-Puccinellietalia maritima</i>) to west of rail in line in and around Broadlough Estuary. Priority habitat at south of CCA at Newcastle at East Coast Nature Reserve. At the southern end of the site, Broad Lough, a brackish, partly tidal lake, has a well-developed saltmarsh community. Light-bellied Brent Goose occurs here in internationally important numbers. Nationally important for Red-throated Diver, Greylag Goose, , Black-headed Gull and Herring Gull. It is probably the most important site in the country for nesting Little Tern and nesting area runs along the entire stretch of the shore line. Seal (QI of Lambay Island SAC) haul out here.

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Enviroment	Landscape and Visual and Seascape	Green	As a natural material, rock would tie in comparatively successfully with the natural qualities of this long stretch of coastline, already influenced by existing rock revetements and the shingle beach material present. The placement of material would be more robust and considered than reactionary measures, and as such would complement and enhance those rock revetements already present. When used consistently, the continuous feature will have a scale and uniformity that will complement the large scale of this stretch of coastline, moderating landscape and visual effects. Rock toe protection is anticipated to have a comparatively reduced land take, facilitating a greater retention of the shoreline.
	Archaeology, Architectural and Cultural Heritage	Yellow	A potential direct impact on one SMR Zone of Notification associated with WI019-038; Prehistoric site - lithic scatter has been identified, there is also the potential for direct impacts to occur on previously unrecorded archaeological heritage. There is the potential for significant indirect setting and visual impacts to occur on one SMR site WI019-038; Prehistoric site - lithic scatter and the associated Zone of Notification. There is also the potential for indirect setting and visual impacts to occur on two further SMR sites (WI25-013; Castle - Anglo-Norman masonry castle and WI025-012012; Promontory fort - coastal). There is the potential for indirect setting and visual impacts to occur on 3 NIAH Sites one of which is also an RPS site (16401912; Station master's house (RPS ref 13-38), 16005001; lighthouse, 16004154; pier/jetty). There is the potential for indirect setting and visual impacts to occur on one further RPS site (RPS ref 19-12; coastguard cottages). There is also the potential for significant direct impacts to occur on previously unrecorded material culture. Significant advantages over Options 1 and 2.
	Marine Archaeology	Green	There are no direct impacts on previously unrecorded wrecks, paleoenvironmental landscapes and material culture, and therefore no potential impact on archaeological features in the intertidal and marine elements.
	Noise and Vibration	Yellow	Noise impact will be from mobile plant when working in proximity to Noise Sensitive Locations. Very low density of population Noise Sensitive Locations along full length of CCA6.2 area. Specific instances of elevated noise will be localised and temporary in this area. Higher noise emissions will be occur during rock toe protections works however these are proposed in areas with a low density of Noise Sensitive Locations CCA6.2 C to D set back from the works. There will be periods of night-time works required to work around tides for all proposed works. No significant vibration impacts from this proposal. Overall this option is similar to other options. No long term operational noise or vibration impacts.
	Air Quality	Green	No operational phase impacts, with the assumption that maintenance requirement is very low hence some advantages. Potential for construction phase impacts associated with potentially dusty activities and construction vehicle emissions. Construction phase impacts would be likely considered short term and dust mitigation can be put in place. Some advantages in options 4, 5 and 8 over options due to no beach nourishment maintenance required. This Option would facilitate operational phase reliance on public transport and reduce reliance on private vehicles for the long term.
	Carbon Management	Green	Whole Life Carbon (tonnes CO2e) was 7% of average across 7 options, therefore it is of most preference to other options. This Option would facilitate operational phase reliance on public transport and reduce reliance on private vehicles for the long term.
	Water Resources	Yellow	This Option is similar to other options as there should be minimal impacts on groundwater
	Geology and Soils	Green	Rock revetment and wave walls are anticipated to cause minimal/moderate disturbance to geological resources in CCA6.2-A, CCA6.2-B and CCA6.2-D, with remobilisation of ground contamination associated with historical and current contaminative land features in CCA6.2-D. Rock toe protection to vegetation in CCA6.2-C is anticipated to cause minimal disturbance to geological resources and areas of potential ground contamination.
	Material and Circular Economy	Green	This Option would provide significant advantages over other options due to its comparatively low materials consumption score (620,275t).
	Waste	Green	This Option would provide significant advantages over other options. Minimal waste would be generated from the removal of existing structures (where rock revetments currently exist, the majority of the rock will be reused within the new revetments). In addition, no wastage is likely to be associated with constructing this option.
	Traffic and Transport	Yellow	Minimal operational impact expected to traffic and transport; the intervention works will be localised to the coast and are not anticipated to affect transport systems or travel demand.

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Engineering/ Technical	Constructability	Green	This Option would be relatively easy to construct as all works are at the shoreline and not open water. Works could be done exclusively by marine equipment and not require a significant landside footprint (depending on the source of the rock armour). This Option has advantages over Option 4 as it requires less works
	Rail Service Impact	Light Green	Minimal impact on operation of railway line. Irish Rail will require to be notified of works as adjacent to the railway line but this is expected to be low risk.
	Reliance on Maintenance Maintenance burden	Orange	This Option has advantages over Option 6 as the areas of beach requiring ongoing monitoring and maintenance are reduced
	Adaptation	Green	This Option does allow for future adaptation as the main works will not be implemented until approximately 2055 so variations in climate change could be accounted for in the design of the works. Future adaptation following implementation of the main works would be limited to changes in the beach profiles.
	Residual Risk	Yellow	This Option would use new hard engineering to manage risk, with less reliance on a beach (which could be stripped out quickly in a significant event). If the new defence was compromised, failure could be rapid.
Planning Risk	Consenting Risk	Light Green	Works are carried out in Natura 2000 sites but to a much lesser extent than other options - less risk of IROPI. Marine based elements require planning (Maritime Area Consent) (Foreshore Licence) (Minister Consent). This is a 'soft engineering' approach that could be more preferable to potential third party objectors. Could be less visual impacts and could be considered to 'feel' more like an amenity space and integrate more appropriately.