

CCA2/3 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 impact on third party land and property as there would be no works.		No impact on third party land and property as there would be no additional works not already being carried out by Irish Rail.
	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)		<p>This Option has significant disadvantages over other options, as the defences deteriorate over time, health and safety risks to the public increase as parts of the defences fail and cliff falls and landslides increase. Failure of the defences could be sudden and catastrophic as the Do Nothing scenario does not include any monitoring or maintenance of the defences.</p> <p>As the defences fail, parts of the failed defences will create debris on the foreshore and in publicly accessible areas. The defences themselves will also become hazards.</p> <p>Cliff falls will results in debris on the tracks and on the beaches.</p>		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 on the beaches and railway line prior to repair works being undertaken. The frequency and scale of the damage and repair works will increase over time.

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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/or damage or 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/or damage or collapse of existing erosion measures will continue and eventually get worse in line with climate change predictions.
	Access		Option 1 (Do Nothing Scenario) is considered to have significant disadvantages over other options as access to and along the beach is likely to be significantly curtailed as a result of erosion events over time.		Option 2 (Do Minimum Scenario) is considered to have some disadvantages over other options as access to and along the beach is likely to be somewhat curtailed as a result of erosion events continue over time.
	Social and Recreation Facilities		Option 1 (Do Nothing Scenario) is considered to have significant disadvantages over other options as the effects of unmitigated climate change will result in continued coastal erosion resulting in a direct impact to the rail line and access to the beach		Option 2 (Do Minimum Scenario) is considered to have some advantages over other options as under this option there would be no effects on existing social and recreational facilities (i.e. beach amenity areas) in this CCA. However the effects of unmitigated climate change will eventually impact these resources.
	Compatibility with Development Plans		This Option has significant disadvantages over the other options. The policy within the relevant development plan identifies coastal zone management and protection of the coast as important. This Option does not provide any coastal protection or protection for the railway line and therefore is not in line with the aims and objectives of the relevant development plan. Option 1 does not address the issue of climate change which is an overarching concern across high level planning policy		This Option 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 as the minimum works rely on repairs it would not fully achieve the objectives of the plans addressing long term climate issues.

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Integration	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. The disadvantage relating to this option is that the minimum works rely on repairs, not a full upgrade so would not fully achieve the objectives of the plans which include the need for climate adaptation.
	Compatibility with Transport Plans		<p>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.</p> <p>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.</p>		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 significant advantages over other options as there would be no construction work and therefore no impact on biodiversity/ protected areas from habitat loss/degradation and disturbance (noise/pollution). There is one SAC (Rockabill to Dalkey Island SAC), one SPA (Dalkey Island SPA being the closest) and one pNHA (Dalkey Coastal Zone and Killiney Hill, that could be effected in a beneficial way. Natural processes would not be constrained. No negative impacts to other QI.		Do Minimum would provide some disadvantage compared to Option 1 as there would be some limited construction work resulting in minimal impact on biodiversity/ protected areas. There is one SAC (Rockabill to Dalkey Island SAC), one SPA (Dalkey Island SPA being the closest) and one pNHA (Dalkey Coastal Zone and Killiney Hill, that could be effected in a minor negative way as repair works could cause disturbance to QI bird species. If unhindered, the natural process of habitat expansion will provide supporting habitat for SPA wintering bird species of the Dalkey Island SPA and foraging for nesting SPA bird species Roseate, Arctic and common terns, (and other SPA at further distance but who's QI bird species utilise this area). Limited impacts to QI species from construction are through impacts to habitats from netting and disturbance to birds and harbour porpoise from noise.

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Core Criteria	Sub Criteria	Option 1	Option 1 Narrative (Do Nothing)	Option 2	Option 2 Narrative (Do Minimum)
Environment	Landscape and Visual and Seascape		This Option has significant disadvantages compared to other options as continued degradation and coastal erosion as a result of no works being undertaken would generate significant adverse landscape/seascape and visual effects.		This Option has some disadvantages compared to other options as continued reactive interventions would compromise the character and quality of this stretch of coastline and its amenity, with ongoing works generating adverse landscape/seascape and visual effects.
	Archaeology, Architectural and Cultural Heritage		This Option has disadvantages over Option 2 (Do Minimum) and significant disadvantages over Options 3 to 8. Continued degradation and coastal flooding as a result of no works being undertaken would generate significant adverse Archaeology, Architectural and Cultural Heritage effects.		This Option has advantages over option 1 and some disadvantages over Options 3 to 8. 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.
	Marine Archaeology		There is one recorded wreck (ID UKHO 6968) in this section. 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.		There is one recorded wreck (ID UKHO 6968) in this section. 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 disadvantages compared to other options. Although 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. In the long term 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.

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Core Criteria	Sub Criteria	Option 1	Option 1 Narrative (Do Nothing)	Option 2	Option 2 Narrative (Do Minimum)
	Air Quality		This Option has significant disadvantages over other options as, although there will be no construction phase impacts there is 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.		This Option has significant disadvantages over other options as although there will be minimal construction phase impacts the reactive Do Minimum construction works will require heavy Machinery resulting in 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		This Option has significant disadvantages over other options due to 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.		This Option has significant disadvantages over other options due to 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 there would be no construction work and therefore no impact on groundwater.		Do Minimum would provide a significant advantage as there would be minimal construction work and therefore negligible impact on groundwater.
	Geology and Soils		This Option has disadvantages over other options as the effects of climate change may result in the erosion of the local geology in the long term. In the short term, there will be no significant impacts to geological resources.		There will be some advantages in the short term compared to other options as there will only be minimal disturbance during the construction. However, the mitigation installed may be not be sufficient to address erosion of geological resources caused by climate change.
	Material and Circular Economy		Do Nothing would provide significant advantages over other options as it avoids the short-term 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).

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Core Criteria	Sub Criteria	Option 1	Option 1 Narrative (Do Nothing)	Option 2	Option 2 Narrative (Do Minimum)
	Waste		This Option would provide significant advantages over other options as it avoids the short-term 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).		This Option 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		This Option has significant disadvantages compared to other options due to the potential for significant disruption to transport in the longer term if no intervention is made. Rail service impacts may lead to overcrowding on buses and/or increased road congestion.		This Option has some disadvantages compared to other options due to the potential unexpected disruptions to transport to make ad hoc repairs. Rail service impacts may lead to overcrowding on buses and/or increased road congestion.
Engineering/ Technical	Constructability		Do Nothing requires no construction works (other than making the area safe).		This Option has disadvantages compared to other options as it is likely to require ad hoc emergency repairs to the defences which could be more complex than planned protection works.
	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 defences, 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 or adaptation but significant monitoring would be required to keep the public safe.		This Option would rely heavily on monitoring and maintenance.

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	Adaptation		No opportunity for adaptation.		This Option has 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	Option 3	Option 3 Narrative (Rock Revetments)	Option 4	Option 4 Narrative (Concrete Seawalls)
Economy		There are likely to be no or minimal impacts on third party lands or local authority lands at this location.		There are likely to be no or minimal impacts on third party lands or local authority lands at this location.
		This Option has significant advantages over other options as it is assumed that, although the rock will be delivered by sea, all the construction of the rock revetments can be undertaken using land based plant which is significantly less costly than marine based plant. Although the volume of rock armour required will be large for this option, it expected to be less than for Options 5, 6 and 8 and there is no requirement for beach recharge which would be a significant additional cost.		This Option has advantages over options 5 to 8 because it is assumed that all construction can be land based which is significantly less costly than marine based construction. This Option has disadvantages to Option 3 because the concrete stepped revetment and concrete seawalls may require significant temporary works which would increase the capital costs compared to the rock revetment construction. This Option will also still require some rock
		This Option has significant advantages over other options as it would only require a routine and post storm monitoring plan and should require minimal maintenance during the design life.		This Option has some disadvantages compare to Option 3 as the concrete revetments would require more regular maintenance than the rock armour. However this maintenance is likely to be patch repairs.
Safety		This Option has advantages over other options as the rock revetments can be constructed using land based plant which has less construction risks compared to marine based plant. The construction of rock revetments is also less complex than detached breakwaters and concrete structures.		This Option would carry significant construction risk due to the need to excavate to formation to install the concrete sea walls along the full length of the frontage. Works of this nature may need a cofferdam to create a dry environment to work in. This would be costly, risky and time consuming.
		This Option has advantages over Options 4 and 5 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 revetments and becoming trapped. Warning signs should be installed to mitigate this. The revetments will significantly reduce the useable area of the beach in the northern section and around the headland. This should deter people from trying to access the northern beach around the headland but if they did, they would become cut off at high tide and this could lead to people traversing across the rock or becoming trapped. Maintenance of the revetments should be very limited and therefore maintenance related Health and Safety risks should be minimal.		This Option has disadvantages compared to Options 3, 6 and 7 due to the increased potential for members of the public becoming cut-off by the tide at the Whiterock area and the increase requirement for maintenance of the concrete seawalls. Along the central section, to the south of the small headland will be a concrete stepped revetment. This will provide access around the headland, however at high tide and during storm events the overtopping rates along the top of the stepped revetment are likely to be higher than the recommended safe limits for pedestrians. There is therefore a risk of members of the public accessing the northern beach during low tide/calm conditions but not having a safe access route back if the conditions change or the tide comes in. To the south of the frontage will be a concrete seawall with rock toe protection at the back of the beach. As the beach levels vary the rock armour could become exposed which could result in uneven ground and/or trip hazards. If the concrete structures are not maintained then these could results in Health and Safety issues such as spalling concrete, exposed reinforcement and large cracks.

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Core Criteria	Option 3	Option 3 Narrative (Rock Revetments)	Option 4	Option 4 Narrative (Concrete Seawalls)
Accessibility and Social Inclusion		<p>This Option has some disadvantages compared to Options 5 to 8 as it would place rock revetment along the majority of the coastline in this CCA, 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.</p>		<p>This Option has some disadvantages compared to Options 5 to 8 as it would place rock revetment, stepped revetment, rock toe protection and concrete sea walls along the length of the coastline in this CCA. The rock revetment is placed at locations that are not publicly accessible, however the placement of stepped revetment, rock toe protection and concrete sea walls will likely be detrimental to the overall amenity value of the beach amenity area for the local community.</p>
		<p>This Option is considered to have some disadvantages when compared to other options as while there will be the imposition of rock revetment along sections of the shoreline of this CCA, access steps will be incorporated into the revetment to ensure any formal and informal access points to the beach amenity area that currently exist and are used by members of the public (for example the current access from Military Road/Strand Road in Killiney) are maintained. Access along the beach is likely to be considerably curtailed under this option however.</p>		<p>This Option is considered to have some disadvantages over other options as the imposition of a concrete sea wall and rock toe protection along sections of the shoreline of this CCA will result in the removal/curtailing of some access along the beach amenity area that currently exist and are used by members of the public. A stepped revetment is also proposed under this option however it is to be positioned against the cliff face at Whiterock Beach, offering no improvement to accessing this location.</p>
		<p>This Option is considered to have some disadvantages over other options as the rock revetment will be placed along the length and breadth of the southern half of the coastline within this CCA. This would likely remove the ability of the public to use this beach amenity area as an area for social and recreational activities. There may be an impact on surfing.</p>		<p>This Option is considered to have some disadvantages over other options as reflection from the concrete seawall and rock toe protection would likely result in the eventual loss of the beach amenity area and thereby the ability of the public to use it for social and recreational activities. There may be an impact on surfing.</p>
		<p>This Option has advantages over other options as it aligns with high level coastal protection and coastal area management objectives within the development plans. The disadvantages relating to this option are: Development within pNHA, within Zoning Objective W (Waterfront development and related uses), Objective 152 (Eire Monument) SLO 74 to redevelop the Killiney Beach Tea Rooms. SLO 18 to promote and develop the Sutton to Sandycove Promenade and cycleway. Boundary Objective 130 that development does not have significant negative impact on the environmental sensitivities, does not detract from the character of the area either visually. Located adjacent to residential zoning/housing from military road. Within An area of a recorded monument and places. Dun Laoghaire Rathdown County Council Development Plan CA7 Construction Materials supports the use of materials that have low to zero embodied energy and CO2 emissions. Significant volume of materials required for the revetment. No enhancement of the areas - utilising naturally occurring green infrastructure, impacting natural habitats, large amount of hard standing, providing coastal recreation amenities or incorporating pedestrian/cycling infrastructure. The revetment results in the loss of some of the beach.</p>		<p>This Option would have benefits as it aligns with high level coastal protection and coastal area management objectives within the development plans. This Option appears to require less material and less surface area when compared with Option 3 resulting in potentially reduced impacts on PNHA. The disadvantages relating to this option are: No enhancement of the areas - utilising naturally occurring green infrastructure, impacting natural habitats, providing coastal recreation amenities or incorporating pedestrian/cycling infrastructure. The Toe would result in the loss of some of the beach. The disadvantages relating to this option are: Development within pNHA, within Zoning Objective W (waterfront development and related uses), SLO 74 to redevelop the Killiney Beach Tea Rooms. SLO 18 to promote and develop the Sutton to Sandycove Promenade and cycleway. Within An area of a recorded monument and place. Boundary Objective 130 that development does not have significant negative impact on the environmental sensitivities, does not detract from the character of the area either visually. Located adjacent to residential zoning/housing from military road. The toe results in the loss of some of the beach but to a lesser extent than Option 3.</p>

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Integration		<p>This Option would have advantages over 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.</p>		<p>This Option would have some disadvantages to other options. It would align with the Transport Climate Change Sectoral Adaptation Plan in terms of protecting the coastline and transport assets. Different to Option 3 as there would be a significant amount of concrete required for stepped revetment and seawall.</p>
		<p>This Option has significant advantages over other options as it 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".</p> <p>The Greater Dublin Area Cycle Network Plan proposes a National Cycle Route, the East Coast Trail, with an indicative route using part of the coastline near Killiney Beach (CCA2/3-D). Providing the intervention works can accommodate the East Coast Trail, this option will support the Transport Strategy.</p>		<p>This Option has significant advantages over other options as it 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".</p> <p>The Greater Dublin Area Cycle Network Plan proposes a National Cycle Route, the East Coast Trail, with an indicative route using part of the coastline near Killiney Beach (CCA2/3-D). Providing the intervention works can accommodate the East Coast Trail, this option will support the Transport Strategy.</p>
		<p>This Option is similar to other options as construction and operational effects are similar. There are two SAC outside the CCA (Rockabill to Dalkey Island SAC (designated for reefs and harbour porpoise), Lambay Island SAC (designated for marine habitats (not impacts) and grey and harbour seals)), one SPA outside the CCA (Dalkey Island SPA being the closest) and one pNHA (Dalkey Coastal Zone and Killiney Hill), that could be effected in a negative way. Bolting, netting and grouting would result in direct impacts to Nationally designated habitats and European designated sites QI species from disturbance. Rock revetment construction could cause disturbance to marine mammals (including seal and there are multiple records in and around Dalkey Island) and QI wintering and nesting species. Rock toe protection on beach would have impacts to Dalkey Coastal Zone and Killiney Hill pNHA.</p>		<p>This Option is similar to other options as construction and operational effects are similar. The two SAC's, one SPA and on pNHA outside the CCA could be affected in a negative way. Bolting and netting and grouting would result in direct impacts to Nationally designated habitats and European designated sites QI species from disturbance. Rock toe construction could cause disturbance to marine mammals (including seal and there are multiple records in and around Dalkey Island) and QI wintering and nesting species. Rock toe protection on beach would have impacts to Dalkey Coastal Zone and Killiney Hill pNHA. A cofferdam may be required for the concrete seawall which would cause additional short term disturbance to QI species during construction period. Stepped revetment may increase use by public increasing current disturbance levels to QI birds and marine mammals.</p>

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Core Criteria	Option 3	Option 3 Narrative (Rock Revetments)	Option 4	Option 4 Narrative (Concrete Seawalls)
Environment	Green	<p>This Option has some advantages compared to other options, as a natural material, rock revetments would tie in comparatively successfully with this stretch of coastline. Rock revetments when used consistently will be of a scale and uniform character that will complement the large sweeping nature of this stretch of coastline, moderating landscape and visual effects. Although the cliffs lining the coastal edge will moderate the scale of these features, in places they require a large land take, which will result in the loss of a large areas of beach which will generate adverse landscape and visual effects.</p>	Green	<p>This Option has significant advantages over other options due to the opportunity to incorporate more compact defences that tie in with existing walling and features associated with the amenity use of sections of this coastline. This more 'compact' treatment facilitates a greater retention of the shoreline characteristics, and less impact on views of the coastal waters. Rock toe protection is less impactful when applied to the comparatively rocky, cliffed section of the CCA, and when applied to the northern part of the CCA provides a softer and more natural transition with the shingle section. The use of a stepped revetment is also considered less impactful on views than a large rock revetment and provides amenity and placemaking opportunities.</p>
	Orange	<p>This Option has advantages over Options 1, 2 and 6. No potential direct impacts on Recorded Monuments or SMR Sites have been identified, however, there is 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 three SMR sites (DU026-012; Battery, DU026-014001; Martello Tower and DU026-014002; Earthwork). There is the potential for indirect setting and visual impacts to occur on 24 RPS Sites.</p>	Orange	<p>This Option has advantages over Options 1, 2 and 6. A potential direct impact on one SMR Zone of Notification associated with (DU026-014001; Martello Tower and DU026-014002; Earthwork) has been identified. There is 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 (DU026-012; Battery). There is the potential for indirect setting and visual impacts to occur on 24 RPS Sites.</p>
	Green	<p>There is one recorded wreck (ID UKHO 6968) 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.</p>	Green	<p>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.</p>
	Green	<p>This Option has advantages over other options as there will be no long term operational noise or vibration impacts. Noise impact during construction will be from mobile plant when working in proximity to population Noise Sensitive Locations. Specific instances of elevated noise will be localised and temporary. There may be periods of night-time works required due to tidal conditions. No significant vibration impacts associated with this option.</p>	Orange	<p>This Option has disadvantages compared to Options 3 and 5 to 8 as it will involve more intrusive construction works and elevated noise in the vicinity of Noise Sensitive Locations. This Option may require some night-time works. Whilst higher noise impacts will likely be experienced with this option, these will be localised and temporary (i.e. during piling if required and excavation works). Temporary to Short-term impacts overall. No long-term significant noise or vibration impacts.</p>

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		<p>This Option has significant advantages over other options due to no ongoing maintenance requirements.</p> <p>This Option would facilitate operational phase reliance on public transport and reduce reliance on private vehicles for the long term.</p> <p>There is potential for some construction phase impacts associated with potentially dusty activities (drilling for bolting) and construction vehicle emissions but no ongoing maintenance from beach nourishment as per some other options. Construction phase impacts would be likely considered short term and dust mitigation can be put in place.</p>		<p>This Option has significant advantages over other options due to no ongoing maintenance requirements.</p> <p>This Option would facilitate operational phase reliance on public transport and reduce reliance on private vehicles for the long term.</p> <p>There is potential for some construction phase impacts associated with potentially dusty activities (drilling for bolting) and construction vehicle emissions but no ongoing maintenance from beach nourishment as per some other options. Construction phase impacts would be likely considered short term and dust mitigation can be put in place.</p>
		<p>Whole Life Carbon (tonnes CO2e) estimate was 121% of average across the 8 options.</p> <p>This Option would facilitate operational phase reliance on public transport and reduce reliance on private vehicles for the long term.</p>		<p>Whole Life Carbon (tonnes CO2e) estimate was 9% of average across 8 options.</p> <p>This Option would facilitate operational phase reliance on public transport and reduce reliance on private vehicles for the long term.</p>
		<p>Minimal impacts to groundwater as minimal below ground construction required.</p>		<p>Below ground structure in the form of a concrete wall could impact groundwater levels, flows and quality.</p>
		<p>There will be minimal/moderate disturbance to geological resources caused by the rock bolting/netting, rock revetment and rock toe protection at selected locations along the cell. Similar to Option 7 and 8 due to anticipated level of disturbance caused.</p>		<p>The concrete seawalls with rock toe protection will caused high disturbance to geological resources. Moderate disturbance is expected as a result of concrete stepped revetment with rock toe protection. The proposed defences may also result in the release of contamination associated with a former mine at White Rock.</p>
		<p>This Option would provide significant advantages over other options due to its comparatively low materials consumption score.</p> <p>The materials consumption score has been calculated based on the application of the Ellen MacArthur Foundation's Material Circularity Indicators (a value between 0 and 1 where higher values indicate a higher circularity) to the quantities of each material that is likely to be used in constructing the option. The Material Circularity Indicator provides a measure of how circular/restorative the material flows of a material/product is likely to be.</p>		<p>This Option would provide some advantages over other options due to its comparatively low materials consumption score (but higher than Option 3).</p>

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		<p>This Option would provide some advantages over other options. No wastage is likely to be associated with constructing this option. 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.</p>		<p>This Option would provide some disadvantages over other options. This Option is likely to be associated with comparatively high wastage (271t). 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.</p>
		<p>This Option is similar to other options as it would have minimal operational impact to traffic and transport; the intervention works will be localised to the coast and are not anticipated to affect transport systems or travel demand.</p>		<p>This Option is similar to other options as it would have minimal operational impact to traffic and transport; the intervention works will be localised to the coast and are not anticipated to affect transport systems or travel demand.</p>
Engineering/ Technical		<p>This Option has significant 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.</p>		<p>This Option would require precast concrete units interlocked together to form a stepped revetment. The revetment would need to be keyed into the underlying material and a rock toe installed for scour protection. This may be challenging to construct due to the location of the wall and may require to be done in a dry environment which adds to the complexity of this option. The sea wall protecting the cliff would need to be installed insitu which further complicates the construction due to the difficult location of the wall.</p>
		<p>Minimal impact on operation of railway line as works are adding to existing infrastructure so no excavation is needed. Irish Rail will require to be notified of works as adjacent to the railway line but this is expected to be low risk.</p>		<p>Minimal impact on the railway line as the seawall looks to be far enough away from the railway line. Interface with Irish Rail for this option is expected to be minimal.</p>
		<p>This Option has advantages over Options 6 to 8 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.</p>		<p>This Option has advantages over Options 6 to 8 as routine monitoring of the concrete seawalls would be required with minor maintenance such as patch repairs throughout the design life, with increased maintenance expected towards the end of the design life.</p>

Core Criteria	Option 3	Option 3 Narrative (Rock Revetments)	Option 4	Option 4 Narrative (Concrete Seawalls)
		<p>This Option has some advantages compared to other options. Future nourishment of the beach in front of the revetments could be undertaken to account for climate changes but additional structures would then be required to hold the beach. Rock revetments can be added to or rebuilt relatively easily if required.</p>		<p>This Option has advantages over other options as, although the concrete wall are hard engineered structures, it would not be too complex to raise the height of the walls in the future if required.</p>
		<p>This Option has advantages over Option 4 as failure of a rock revetment is very unlikely to be sudden, failure would be progressive in the form of some loss of rock from the structure or slumping/settlement of the revetment which would compromise its performance but would not lead to sudden or catastrophic failure.</p>		<p>This Option has disadvantages over Option 3 as failure of concrete walls (e.g. due to undermining) can be sudden.</p>
<p>Planning Risk</p>		<p>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. This Option will require a Maritime Area Consent.</p>		<p>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. This Option will require a Maritime Area Consent. On comparison with Option 3 there is generally a need for more concrete and hard standing as well as greater depth into the beach area.</p>

CCA2/3 Emerging Preferred Option Multi Criteria Analysis

Core Criteria	Option 5	Option 5 Narrative (Detached Breakwaters)	Option 6	Option 6 Narrative (Breakwaters with nourishment)
Economy		There are likely to be no or minimal impacts on third party lands or local authority lands at this location.		There are likely to be no or minimal impacts on third party lands or local authority lands at this location.
		This Option has disadvantages compared to Options 3 and 4 as it would be more costly to construct as the breakwaters would require marine based construction which is more expensive than land based construction		This Option has significant disadvantages over all other options as it is likely to be the most expensive option to construct due to the plant required for constructing the breakwaters and the beach nourishment. The breakwaters will require marine based plant for construction. The beach nourishment will require a dredger to obtain the beach material and then pump it ashore before land based plant is used to move the material into place.
		This Option should require minimal maintenance costs throughout the design life. However any maintenance that is required would be more expensive than for Option 3 due to the marine plant required to undertake the repairs		This Option has disadvantages compared to Option 3 to 5 as regular monitoring and maintenance of the beaches will be required to maintain the design beach. There is also likely to be a need for future renourishment during the design life
Safety		This Option has disadvantages over options 3, 7and 8 because the detached breakwaters can be challenging to construct in open water and would require the exclusive use of marine equipment to construct and carry increased safety risks.		This Option has disadvantages over options 3, 7and 8 because the detached breakwaters can be challenging to construct in open water and would require the exclusive use of marine equipment to construct and carry increased safety risks. The beach no nourishment is a relatively straightforward process and the Health and Safety aspects would be managed by the specialist contractor undertaking the works. Interface with the public would need to be managed and appropriate segregation installed to ensure no public access during the works.
		This Option has disadvantages compared to Option 3 and 7 due to the likely impact on amenity use in the area. This Option includes detached breakwaters but without any beach nourishment, therefore although the breakwaters should lead to beach material being retained on the beach they are unlikely to lead to large beach bays forming which would connect the beaches to the breakwaters. This should reduce the chance of people walking out to the breakwaters and potentially becoming trapped. However the lack of larger beaches has the potential for more dangerous conditions as an amenity area due to increased currents and less sheltered conditions in the lee of the breakwaters. This Option is likely to require a number of quite long breakwaters in order to sufficiently reduce the wave action at the shore. People using the beach and sea for amenity use may venture beyond the breakwaters and due to the number of breakwaters and potentially small gaps between the structures it could then become difficult to get back to shore.		This Option has significant advantages over other option as it will improve the bathing and amenity conditions. In the lee of the breakwaters the beach material will build up creating larger wider beaches which will improve access and reduce the chances of people being cut off by the tide. The larger beaches will also create some more sheltered bathing areas where the beaches are larger and therefore shallower water depths. The larger beaches could encourage people to try to walk out to the breakwaters getting trapped in the breakwaters if they climb on them. Warning signs should be installed to deter people from accessing the breakwaters. 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.

CCA2/3 Emerging Preferred Option Multi Criteria Analysis

Core Criteria	Option 5	Option 5 Narrative (Detached Breakwaters)	Option 6	Option 6 Narrative (Breakwaters with nourishment)
Accessibility and Social Inclusion	Green	This Option has advantages over Options 3 and 4 as the beach amenity area would largely remain as it is now albeit with some disadvantages to its recreational use (see social and recreational facilities below).	Green	This Option is considered to have some advantages over other options as it provides enhanced beach amenity areas along the coastline of this CCA. This would contribute positively to the amenity value of the areas as well as the general public perception of the area. The small breakwaters proposed under this option may have some disadvantages to the recreational use of the beach amenity area (see social and recreational facilities below).
	Green	This Option is considered to be have some advantages other options as the vast majority of formal and informal access points to the beach amenity area that currently exist and used by members of the public will be maintained. There is one identified informal access at Mount Mapas that would be directly impacted from the imposition of a concrete sea wall.	Green	This Option is considered to have significant advantages over other options as any informal and formal access points to the beach amenity area that currently exist and used by members of the public will be maintained. Access along the length of the beach amenity area will likely be improved as a result of beach nourishment.
	Orange	This Option has some disadvantages over other options as it will change the natural dynamics of the beach. It likely to make some water-based activities unsafe and dangerous with the placement of detached breakwaters offshore. Expected significant adverse impact on surfing.	Green	This Option is considered to have some advantages over other options as it provides for enhanced/additional beach amenity areas (extending from Whiterock Beach to the southern extent of Killiney Beach/Strand) with the provision of beach nourishment and detached breakwaters close to shore. The detached breakwaters may result in some water-based activities becoming unsafe and dangerous to undertake. Expected significant adverse impact on surfing.
	Orange	This Option would have some disadvantages. It would impact on Marine Policy /Map based objectives such as SAC and protection of Dublin Biosphere UNESCO site. There is potential for impact on Marine sites such as Heritage Assets, Fisheries and Ports, harbours and Shipping. The breakwaters are located within UNESCO site (located within DLR no specific development objective). This Option requires less infrastructure on the beach area - much of the key infra is pushed out to sea but this requires a significant volume of material. Boundary Objective 130 that development does not have significant negative impact on the environmental sensitivities, does not detract from the character of the area either visually. Located adjacent to residential zoning/housing from Military Road.	Orange	This Option would have some disadvantages. It would impact on Marine Policy /Map based objectives such as SAC and protection of Dublin Biosphere UNESCO site. Potential for impact on Marine sites such as Heritage Assets, Fisheries and Ports, harbours and Shipping due to breakwaters. Advantage includes: enhancement of the area with beach amenity and coastal recreation amenity, elements of green infrastructure. Breakwaters located within UNESCO site (located within DLR no specific development objective). This Option appears to require much less concrete and hard infrastructure area than other options = reduced impacts on PNHA.

CCA2/3 Emerging Preferred Option Multi Criteria Analysis

Core Criteria	Option 5	Option 5 Narrative (Detached Breakwaters)	Option 6	Option 6 Narrative (Breakwaters with nourishment)
Integration		<p>This Option has some advantages to other options. It generally aligns with Transport Climate Change Sectoral Adaptation Plan in terms of protecting the coastline and transport assets. However have negative marine based impacts. Requires significant volumes of rock to be transported offshore for the breakwaters as well as concrete for the seawall. This Option appears to use the least amount of concrete on comparison with all other options.</p>		<p>This Option is similar to other options, it generally aligns with Transport Climate Change Sectoral Adaptation Plan in terms of protecting the coastline and transport assets. However would have negative marine based impacts. Requires significant volumes of rock to be transported offshore for the breakwaters. Requires significant volume of sand for beach nourishment to be transported to site. However, it appears to have less concrete and hard infrastructure to other options.</p>
		<p>This Option has significant advantages over other options as it 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".</p> <p>The Greater Dublin Area Cycle Network Plan proposes a National Cycle Route, the East Coast Trail, with an indicative route using part of the coastline near Killiney Beach (CCA2/3-D). Providing the intervention works can accommodate the East Coast Trail, this option will support the Transport Strategy.</p>		<p>This Option has significant advantages over other options as it 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".</p> <p>The Greater Dublin Area Cycle Network Plan proposes a National Cycle Route, the East Coast Trail, with an indicative route using part of the coastline near Killiney Beach (CCA2/3-D). Providing the intervention works can accommodate the East Coast Trail, this option will support the Transport Strategy.</p>
		<p>This Option is similar to other options as construction and operational effects are similar. The two SAC's, one SPA and on pNHA outside the CCA could be affected in a negative way. Bolting and netting and grouting would result in direct impacts to Nationally designated habitats and European designated sites QI species from disturbance. The detached breakwaters are not in a European designated area. There is potential for changes in tidal movement due to presence of breakwaters which may alter feeding opportunities for QI bird species of the nearby SPA though loss or change in habitat reducing prey species availability. Disturbance to foraging QI birds and marine mammals during construction of breakwaters.</p>		<p>This Option is similar to other options as construction and operational effects are similar. The two SAC's, one SPA and on pNHA outside the CCA could be affected in a negative way. Bolting and netting and grouting would result in direct impacts to Nationally designated habitats and European designated sites QI species from disturbance. The detached breakwaters are not in a European designated area. There is potential for changes in tidal movement due to presence of breakwaters which may alter feeding opportunities for QI bird species of the nearby SPA though loss or change in habitat reducing prey species availability. Disturbance to foraging QI birds and marine mammals during construction of breakwaters. Beach recharge and future beach nourishment could cause disturbance in the long term. Presence of Annex I species (annual vegetation drift lines) known to be present to the north of Killiney Dart station could be destroyed.</p>

CCA2/3 Emerging Preferred Option Multi Criteria Analysis

Core Criteria	Option 5	Option 5 Narrative (Detached Breakwaters)	Option 6	Option 6 Narrative (Breakwaters with nourishment)
Environment	Red	<p>This Option has significant disadvantages compared to other options. Whilst it requires less intensive intervention at the coastal edge, and therefore facilitates the substantive retention of the existing beach and intertidal areas, large scale detached breakwaters applied consistently within the local coastal waters would be conspicuous, and would generate significant adverse landscape/seascape and visual effects.</p>	Red	<p>This Option has significant disadvantages compared to other options. Whilst beach nourishment has potential to enhance the character and amenity value of this section of coastline, detached breakwaters within the local coastal waters would be conspicuous, and would generate significant adverse landscape/seascape and visual effects. A key landscape and visual characteristic of this section of coastline is its long sweeping nature, which in combination with the bounding cliff line generates a large scale. In addition to the creation of detached breakwaters, the formation of a series of smaller bays through the disposition of beach nourishment would appear artificial and would adversely influence the natural characteristics of the coastline.</p>
	Green	<p>A potential direct impact on one SMR Zone of Notification associated with (DU026-014001; Martello Tower and DU026-014002; Earthwork) has been identified. There is 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 three SMR sites (DU026-012; Battery, DU026-014001; Martello Tower and DU026-014002; Earthwork). There is the potential for indirect setting and visual impacts to occur on 24 RPS Sites (RPS ref 1609, 1608, 1607, 1605, 1604, 1603, 1601, 1600, 1628, 1642, 1641, 1644, 1681, 1697, 1721, 1716, 1709, 1737, 1737, 1757, 1755, 1753, 1751 and 1745). Significant advantages over Options 1, 2 and 6.</p>	Orange	<p>This Option has a potential direct impact on one SMR Zone of Notification associated with (DU026-014001; Martello Tower and DU026-014002; Earthwork). There is also the potential for significant indirect setting and visual impacts to occur on three SMR sites (DU026-012; Battery, DU026-014001; Martello Tower and DU026-014002; Earthwork). There is the potential for indirect setting and visual impacts to occur on 24 RPS Sites (RPS ref 1609, 1608, 1607, 1605, 1604, 1603, 1601, 1600, 1628, 1642, 1641, 1644, 1681, 1697, 1721, 1716, 1709, 1737, 1737, 1757, 1755, 1753, 1751 and 1745). There is also the potential for direct impacts to occur on previously unrecorded archaeological heritage. Significant disadvantage over options 3, 4, 5, 7 and 8.</p>
	Orange	<p>There is one recorded wreck (ID UKHO 6968) 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. This Option has some advantage over Option 6 as there is no beach nourishment</p>	Red	<p>This Option has significant disadvantages over other options due to the construction of breakwaters in the marine environment and the marine based activities associated with beach recharge. There is one recorded wreck (ID UKHO 6968) 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</p>
	Green	<p>This Option has advantages over other options as the breakwater areas are set back from population Noise Sensitive Locations but have potential for underwater noise impacts depending on construction methodologies and sensitive habitats. Impacts will be localised and temporary with no long-term significant noise or vibration impacts.</p>	Green	<p>This Option has advantages over other options as the breakwater areas are set back from population Noise Sensitive Locations but have potential for underwater noise impacts depending on construction methodologies and sensitive habitats. Impacts will be localised and temporary with no long-term significant noise or vibration impacts. Overall this option is similar to other options with some advantages due to absence of intrusive high noise activities close to Noise Sensitive Locations, however, this option will require more regular maintenance on an ongoing basis, hence impacts are short to long-term.</p>

CCA2/3 Emerging Preferred Option Multi Criteria Analysis

Core Criteria	Option 5	Option 5 Narrative (Detached Breakwaters)	Option 6	Option 6 Narrative (Breakwaters with nourishment)
		<p>This Option has significant advantages over other options due to no ongoing maintenance requirements.</p> <p>This Option would facilitate operational phase reliance on public transport and reduce reliance on private vehicles for the long term.</p> <p>There is potential for some construction phase impacts associated with potentially dusty activities (drilling for bolting) and construction vehicle emissions but no ongoing maintenance from beach nourishment as per some other options. Construction phase impacts would be likely considered short term and dust mitigation can be put in place.</p>		<p>This Option would need ongoing monitoring and maintenance requirements to maintain the beach to the design levels. The maintenance has the potential for dust emissions but can be mitigated.</p> <p>This Option would facilitate operational phase reliance on public transport and reduce reliance on private vehicles for the long term.</p> <p>There is potential for construction phase impacts associated with potentially dusty activities, with beach nourishment having a higher potential for dust. Construction phase impacts would be likely considered short term and dust mitigation can be put in place.</p>
		<p>Whole Life Carbon (tonnes CO2e) was 307% of average across 8 options.</p> <p>This Option would facilitate operational phase reliance on public transport and reduce reliance on private vehicles for the long term.</p>		<p>Whole Life Carbon (tonnes CO2e) was 49% of average across 8 options.</p> <p>This Option would facilitate operational phase reliance on public transport and reduce reliance on private vehicles for the long term.</p>
		<p>Below ground structures in the form of a concrete wall at Whiterock could impact groundwater levels, flows and quality locally.</p>		<p>Minimal impacts to groundwater as no below ground construction required.</p>
		<p>The detached breakwaters will cause moderate disturbance to geological resources across the cell. Strengthening and raising a seawall will cause minimal disturbance to geological resources, assuming no ground disturbance.</p>		<p>The detached breakwaters, beach nourishment and repairs to the existing sea walls will result in minimal/moderate disturbance to geological resources. Minimal/moderate disturbance is expected in the locations of rock toe protection</p>
		<p>This Option would provide some disadvantages over other options due to its comparatively high materials consumption score .</p>		<p>This Option would provide significant disadvantages over other options due to its comparatively high materials consumption score.</p>

CCA2/3 Emerging Preferred Option Multi Criteria Analysis

Core Criteria	Option 5	Option 5 Narrative (Detached Breakwaters)	Option 6	Option 6 Narrative (Breakwaters with nourishment)
		<p>This Option would provide some disadvantages over other options. This Option is likely to be associated with comparatively high wastage (154t). 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.</p>		<p>This Option would provide significant advantages over other options. This Option is likely to be associated with comparatively low wastage (0.5t). 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.</p>
		<p>This Option is similar to other options as it would have minimal operational impact to traffic and transport; the intervention works will be localised to the coast and are not anticipated to affect transport systems or travel demand.</p>		<p>This Option is similar to other options as it would have minimal operational impact to traffic and transport; the intervention works will be localised to the coast and are not anticipated to affect transport systems or travel demand.</p>
Engineering/ Technical		<p>This Option would be 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 which can be constructed with land based plant.</p>		<p>This Option includes detached breakwaters and beach nourishment. The detached breakwaters would be easier to construct than Option 5 as they are smaller however would still be subject to the same construction risks. Beach nourishment is relatively straightforward and could be completed with suitable marine equipment using dredged material.</p>
		<p>Minimal interface with Irish Rail expected for this option.</p>		<p>Minimal interface with Irish Rail expected for this option.</p>
		<p>This Option has advantages over Options 6 to 8 as routine monitoring of the detached breakwaters would be required with minor maintenance throughout the design life, with increased maintenance expected towards the end of the design life.</p>		<p>This Option has disadvantages over Options 3 to 8 due to the need for monitoring and maintenance (recycling or nourishment) of the beaches during the design life. A monitoring programme should be prepared to ensure the regular monitoring is undertaken so that maintenance works can be planned.</p> <p>The revetments and detached breakwaters should require minimal maintenance but routine inspections and post storm inspections should be undertaken.</p>

Core Criteria	Option 5	Option 5 Narrative (Detached Breakwaters)	Option 6	Option 6 Narrative (Breakwaters with nourishment)
		<p>This Option is similar to Option 3 in that future nourishment of the beach could be undertaken to account for climate change but additional structures would then be required to hold the beach. Some raising of the seawalls could be undertaken in the future if required.</p>		<p>The nourished beaches could be adapted to account for climate change, either through increased nourishment and maintenance or through adding additional material to increase the size of the beaches.</p>
		<p>Breakwaters will reduce wave energy at the shoreline, making shoreline structures less likely to fail quickly. Breakwater failure is generally slow and not catastrophic.</p>		<p>This Option relies on the nourished beaches to prevent erosion. The breakwaters will disrupt the wave energy so that the beaches are maintained. Failure of the breakwaters is generally slow and not catastrophic. Failure of the beach is likely to be slow, there may be erosion of the beach over time or reshaping of the beach after a storm event reducing its impact. However, failure is unlikely to be catastrophic and would be prevented through routine monitoring and maintenance.</p>
Planning Risk		<p>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. This Option will 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.</p>		<p>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. This Option will require a Maritime Area 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.</p>

CCA2/3 Emerging Preferred Option Multi Criteria Analysis

Core Criteria	Option 7	Option 7 Narrative (Groynes with Nourishment)	Option 8	Option 8 Narrative (Beach Nourishment with/without wave walls and breakwaters)
Economy	Yellow	There are likely to be no or minimal impacts on third party lands or local authority lands at this location.	Yellow	There are likely to be no or minimal impacts on third party lands or local authority lands at this location.
	Light Green	This Option would have lower construction costs than Options 5 and 6 as the rock groynes could be constructed with land based plant rather than marine based which will be less costly. This Option includes beach nourishment in addition to the rock armour which will make it more costly than Option 3 due to the additional material and the requirement for a dredger to obtain the beach material and pump it ashore.	Orange	This Option has advantages over Option 6 as it has less detached breakwaters and therefore the construction costs will be reduced. This Option has disadvantages compared to Options 3, 4 and 7 as the detached breakwaters will be more expensive to construct due to the need for marine based construction. The presence of beach nourishment will make this option more costly than Option 5.
	Orange	This Option has disadvantages compared to Option 3 to 5 as regular monitoring and maintenance of the beaches will be required to maintain the design beach. There is also likely to be a need for future renourishment during the design life	Orange	This Option has disadvantages compared to Option 3 to 5 as regular monitoring and maintenance of the beaches will be required to maintain the design beach. There is also likely to be a need for future renourishment during the design life
Safety	Light Green	This Option has advantages over Options 5 and 6 as the construction of the groynes has less Health and Safety risks compared to breakwaters due to the smaller footprint, scope of works and location of the works meaning construction can be land based.	Orange	This Option would carry some construction safety risk due to access of the work area. The works would be relatively straight forward as no excavation is needed to raise the seawall against the cliff.
	Green	This Option is considered to have some advantages over other options as it provides enhanced beach amenity areas along the southern section of the CCA. This Option will result in beach material building up between the groynes creating larger wider beaches which will improve access and reduce the chances of people being cut off by the tide. 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.	Green	This Option includes detached breakwaters and beach nourishment. In the lee of the breakwaters the beach material will build up creating larger wider beaches which will improve access and reduce the chances of people being cut off by the tide. The larger beaches will also create some more sheltered bathing areas where the beaches are larger and therefore shallower water depths. The larger beaches could encourage people to try to walk out to the breakwaters getting trapped in the breakwaters if they climb on them. Warning signs should be installed to deter people from accessing the breakwaters. 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.

CCA2/3 Emerging Preferred Option Multi Criteria Analysis

Core Criteria	Option 7	Option 7 Narrative (Groynes with Nourishment)	Option 8	Option 8 Narrative (Beach Nourishment with/without wave walls and breakwaters)
Accessibility and Social Inclusion	High	This Option is considered to have some advantages over other options as it provides for enhanced/additional beach amenity areas (extending from Whiterock Beach to the southern extent of Killiney Beach/Strand) with the provision of beach nourishment and groynes close to shore. The placement of groynes will enhance the beach amenity area but also limit access along its length.	High	This Option is considered to have some advantages over other options as it provides enhanced beach amenity areas along the southern section of the CCA. This would contribute positively to the amenity value of the area as well as the general public perception of the area.
	High	This Option is considered to have some advantages over other options as while the provision of groynes will improve the beach amenity area and thereby improving access to it, groynes also somewhat limit access along the length of the beach area.	High	This Option is considered to have significant advantages over other options as any informal and formal access points to the beach amenity area that currently exist and used by members of the public will be maintained. Access along the length of the beach amenity area will likely be improved as a result of beach nourishment.
	High	This Option is considered to have some advantages over other options as it provides for enhanced/additional beach amenity areas (extending from Whiterock Beach to the southern extent of Killiney Beach/Strand) with the provision of beach nourishment and groynes close to shore. The placement of groynes will enhance the beach amenity area but also limit access along its length. Likely impact on surfing.	High	This Option is considered to have some advantages over other options as it provides for enhanced/additional beach amenity areas (extending from Whiterock Beach to the southern extent of Killiney Beach/Strand) with the provision of rock revetment, rock toe protection, concrete seawalls, beach nourishment and detached breakwaters close to shore. The detached breakwaters may result in some water-based activities becoming unsafe and dangerous to undertake. Expected significant adverse impact on surfing.
	Low	This Option would have some disadvantages. It would impact on Marine Policy /Map based objectives such as SAC and protection of Dublin Biosphere UNESCO site. Potential for impact on Marine sites such as Heritage Assets, Fisheries and Ports, harbours and Shipping. Advantage includes: enhancement of the area with beach amenity and coastal recreation amenity, elements of green infrastructure. No marine map based objectives/sites. This Option appears to require much less volume of materials and surface area than other options = reduced impacts on PNHA.	Low	This Option would have some disadvantages when compared to other options. It would impact on Marine Policy /Map based objectives such as SAC and protection of Dublin Biosphere UNESCO site. Potential for impact on Marine sites such as Heritage Assets, Fisheries and Ports, harbours and Shipping. Advantage includes: enhancement of the area with beach amenity and coastal recreation amenity, elements of green infrastructure.

CCA2/3 Emerging Preferred Option Multi Criteria Analysis

Core Criteria	Option 7	Option 7 Narrative (Groynes with Nourishment)	Option 8	Option 8 Narrative (Beach Nourishment with/without wave walls and breakwaters)
Integration		<p>This Option would have some advantages. It generally aligns with Transport Climate Change Sectoral Adaptation Plan in terms of protecting the coastline and transport assets. However potentially fewer negative marine based impacts.</p> <p>On comparison with Option 6 it requires significantly less volume of rock for breakwaters. However, it does require a larger volume of concrete.</p>		<p>This Option generally aligns with Transport Climate Change Sectoral Adaptation Plan in terms of protecting the coastline and transport assets. However would have negative marine based impacts.</p> <p>Requires significant volumes of rock to be transported offshore for the breakwaters. Requires a significant volume of sand to be transported to site for beach nourishment.</p>
		<p>This Option has significant advantages over other options as it 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".</p> <p>The Greater Dublin Area Cycle Network Plan proposes a National Cycle Route, the East Coast Trail, with an indicative route using part of the coastline near Killiney Beach (CCA2/3-D). Providing the intervention works can accommodate the East Coast Trail, this option will support the Transport Strategy.</p>		<p>This Option has significant advantages over other options as it 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".</p> <p>The Greater Dublin Area Cycle Network Plan proposes a National Cycle Route, the East Coast Trail, with an indicative route using part of the coastline near Killiney Beach (CCA2/3-D). Providing the intervention works can accommodate the East Coast Trail, this option will support the Transport Strategy.</p>
		<p>This Option is similar to other options as construction and operational effects are similar. The two SAC's, one SPA and on pNHA outside the CCA could be affected in a negative way. Bolting, netting and grouting would result in direct impacts to Nationally designated habitats and European designated sites QI species from disturbance. Potential for changes in sediment movement along beach due to groynes and construction would disturb foraging birds and marine mammals during nourishment. Beach is generally disturbed by public already.</p> <p>Replenishment of sand in future may be needed, causing disturbance in the long term.</p> <p>Presence of Annex I species (annual vegetation drift lines) known to be present to the north of Killiney Dart station could be destroyed.</p>		<p>This Option is similar to other options as construction and operational effects are similar. The two SAC's, one SPA and on pNHA outside the CCA could be affected in a negative way. Bolting, netting and grouting would result in direct impacts to Nationally designated habitats and European designated sites QI species from disturbance. The detached breakwaters are not in a European designated area. There is potential for changes in tidal movement due to presence of breakwaters which may alter feeding opportunities for QI bird species of the nearby SPA though loss or change in habitat reducing prey species availability. Disturbance to foraging QI birds and marine mammals during construction of breakwaters. Beach recharge and future beach nourishment could cause disturbance in the long term. Presence of Annex I species (annual vegetation drift lines) known to be present to the north of Killiney Dart station could be destroyed.</p>

CCA2/3 Emerging Preferred Option Multi Criteria Analysis

Core Criteria	Option 7	Option 7 Narrative (Groynes with Nourishment)	Option 8	Option 8 Narrative (Beach Nourishment with/without wave walls and breakwaters)
Environment	High	<p>Whilst beach nourishment has potential to enhance the character and amenity value of this section of coastline, groynes protruding out into the coastal waters, and the resulting accumulation of beach material, would contrast the long sweeping nature of this section of coastline. The groynes would however be placed at either end of the bay where their visual influence would be moderated by the natural rock protrusions here, with those present within the bay itself being conspicuous in lower states of the tide. Effects would be similar to Options 3 and 4, albeit linear protrusions out to sea, rather than features following the coastal edge, are considered comparatively adverse in their influence.</p>	High	<p>Whilst beach nourishment has potential to enhance the character and amenity value of this section of coastline, detached breakwaters within the local coastal waters would be conspicuous, and would generate significant adverse landscape/seascape and visual effects. Compared with Option 6, this option is comparatively discrete, with breakwaters focused at the northern end of the bay. However, breakwaters would remain conspicuous and the creation of smaller bays would appear artificial.</p>
	High	<p>No potential direct impacts on Recorded Monuments or SMR Sites have been identified, however, there is the potential for direct impacts to occur on previously unrecorded archaeological heritage. There is the potential for indirect setting and visual impacts to occur on three SMR sites (DU026-012; Battery, DU026-014001; Martello Tower and DU026-014002; Earthwork). There is the potential for indirect setting and visual impacts to occur on 24 RPS Sites (RPS ref 1609, 1608, 1607, 1605, 1604, 1603, 1601, 1600, 1628, 1642, 1641, 1644, 1681, 1697, 1721, 1716, 1709, 1737, 1737, 1757, 1755, 1753, 1751 and 1745). Significant advantages over Options 1, 2 and 6.</p>	High	<p>No potential direct impacts on Recorded Monuments or SMR Sites have been identified, however, there is 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 three SMR sites (DU026-012; Battery, DU026-014001; Martello Tower and DU026-014002; Earthwork). There is the potential for indirect setting and visual impacts to occur on 24 RPS Sites (RPS ref 1609, 1608, 1607, 1605, 1604, 1603, 1601, 1600, 1628, 1642, 1641, 1644, 1681, 1697, 1721, 1716, 1709, 1737, 1737, 1757, 1755, 1753, 1751 and 1745). Significant advantages over Options 1, 2 and 6.</p>
	High	<p>There is one recorded wreck (ID UKHO 6968) 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 groynes and associated construction activity; and in connection with the groyne construction in the intertidal zone and beach nourishment with the use of plant such as dredgers and associated activities during the transfer of shingle onto the beach.</p>	High	<p>There is one recorded wreck (ID UKHO 6968) 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 the groyne construction in the intertidal zone and beach nourishment with the use of plant such as dredgers and associated activities during the transfer of shingle onto the beach.</p>
	High	<p>Noise impact will be from mobile plant when working in proximity to Noise Sensitive Locations along beach areas but majority of works will generate low noise impacts. Specific instances of elevated noise will be localised and temporary. There will be potential periods of night-time works required to work around tides. No significant vibration impacts associated with this option.</p> <p>Overall this option is similar to other options with some advantages due to absence of intrusive high noise activities close to Noise Sensitive Locations, however, this option will require more</p>	High	<p>This Option has the potential for some elevated noise when works are occurring in the vicinity of Noise Sensitive Locations. Impacts will be localised and temporary (i.e. during piling if required and excavation works). This Option will require more regular maintenance on an ongoing basis for beach nourishment, hence impacts are short to long-term.</p>

CCA2/3 Emerging Preferred Option Multi Criteria Analysis

Core Criteria	Option 7	Option 7 Narrative (Groynes with Nourishment)	Option 8	Option 8 Narrative (Beach Nourishment with/without wave walls and breakwaters)
		<p>This Option would need ongoing monitoring and maintenance requirements to maintain the beach to the design levels. The maintenance has the potential for dust emissions but can be mitigated.</p> <p>This Option would facilitate operational phase reliance on public transport and reduce reliance on private vehicles for the long term.</p> <p>There is potential for construction phase impacts associated with potentially dusty activities, with beach nourishment having a higher potential for dust. Construction phase impacts would be likely considered short term and dust mitigation can be put in place.</p>		<p>This Option would need ongoing monitoring and maintenance requirements to maintain the beach to the design levels. The maintenance has the potential for dust emissions but can be mitigated.</p> <p>This Option would facilitate operational phase reliance on public transport and reduce reliance on private vehicles for the long term.</p> <p>There is potential for construction phase impacts associated with potentially dusty activities, with beach nourishment having a higher potential for dust. Construction phase impacts would be likely considered short term and dust mitigation can be put in place.</p>
		<p>Whole Life Carbon (tonnes CO2e) was 15% of average across 8 options.</p> <p>This Option would facilitate operational phase reliance on public transport and reduce reliance on private vehicles for the long term.</p>		<p>Whole Life Carbon (tonnes CO2e) was 42% of average across 8 options.</p> <p>This Option would facilitate operational phase reliance on public transport and reduce reliance on private vehicles for the long term.</p>
		<p>Minimal impacts to groundwater as minimal below ground construction required.</p>		<p>Below ground structures in the form of a concrete wall at Killiney Beach and South Killiney could impact groundwater levels, flows and quality locally.</p>
		<p>The combination of beach nourishment and groynes will cause minimal/moderate disturbance to geological resources. Similar to Option 3 and 8 due to anticipated level of disturbance caused.</p>		<p>The detached breakwaters and beach nourishment will cause moderate disturbance to geological resources. Minimal/moderate disturbance is expected in the vicinity of low concrete wave walls and rock toe protection. Similar to Option 3 and 7 due to anticipated level of disturbance caused.</p>
		<p>This Option would provide some advantages over other options due to its comparatively low materials consumption score.</p>		<p>This Option would provide significant disadvantages over other options due to its comparatively high materials consumption score.</p>

CCA2/3 Emerging Preferred Option Multi Criteria Analysis

Core Criteria	Option 7	Option 7 Narrative (Groynes with Nourishment)	Option 8	Option 8 Narrative (Beach Nourishment with/without wave walls and breakwaters)
		<p>This Option would provide significant advantages over other options. This Option is likely to be associated with comparatively low wastage (0.5t). 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.</p>		<p>This Option would provide some advantages over other options. This Option is likely to be associated with comparatively low wastage (82t). 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.</p>
		<p>This Option is similar to other options as it would have minimal operational impact to traffic and transport; the intervention works will be localised to the coast and are not anticipated to affect transport systems or travel demand.</p>		<p>This Option is similar to other options as it would have minimal operational impact to traffic and transport; the intervention works will be localised to the coast and are not anticipated to affect transport systems or travel demand.</p>
Engineering/ Technical		<p>This Option has advantages over Options 5 and 6 as the groynes are relatively small structures and can be constructed using land based plant. Beach nourishment is relatively straightforward and could be completed with suitable marine equipment using dredged material but provides an added complexity compared to Option 3</p>		<p>This Option has disadvantages over other options due to the combination of different structures required.</p>
		<p>Minimal interface with Irish Rail expected for this option.</p>		<p>Minimal interface with Irish Rail expected for this option.</p>
		<p>This Option has disadvantages over Options 3 to 8 due to the need for monitoring and maintenance(recycling or nourishment) of the beaches during the design life. A monitoring programme should be prepared to ensure the regular monitoring is undertaken so that maintenance works can be planned.</p> <p>The revetments and groynes should require minimal maintenance but routine inspections and post storm inspections should be undertaken.</p>		<p>This Option has disadvantages over Options 3 to 8 due to the need for monitoring and maintenance(recycling or nourishment) of the beaches during the design life. A monitoring programme should be prepared to ensure the regular monitoring is undertaken so that maintenance works can be planned.</p> <p>The revetments and breakwaters should require minimal maintenance but routine inspections and post storm inspections should be undertaken.</p>

Core Criteria	Option 7	Option 7 Narrative (Groynes with Nourishment)	Option 8	Option 8 Narrative (Beach Nourishment with/without wave walls and breakwaters)
		<p>The nourished beaches could be adapted to account for changes in climate change, either through increased nourishment and maintenance or through adding additional material to increase the size of the beaches .</p>		<p>The nourished beaches could be adapted to account for changes in climate change, either through increased nourishment and maintenance or through adding additional material to increase the size of the beaches. Some raising of the seawalls could also be undertaken.</p>
		<p>This Option relies on the nourished beaches to prevent erosion. The groynes will hold the beaches in place. Failure of the groynes would be slow and would not be catastrophic.</p>		<p>This Option relies on the nourished beaches to prevent erosion. The breakwaters will disrupt the wave energy so that the beaches are maintained. Failure of the breakwaters is generally slow and not catastrophic. Failure of the beach is likely to be slow erosion of the beach over time or reshaping of the beach after a storm event reducing its impact but failure is unlikely to be catastrophic and would be prevented through routine monitoring and maintenance.</p>
Planning Risk		<p>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. This Option will require a Maritime Area Consent. Less material required for beach nourishment than other options. Use of groynes requiring hard infrastructure that could 'dissect the beach' and impact upon its amenity value.</p>		<p>A full upgrade of existing defences would protect the area for a longer time in line with planning policy. This Option will require a Maritime Area Consent. Use of concrete sea wall over longer lengths of beach area than options with less hard engineering. Also, more depth to area of beach nourishment required than other options.</p>