Chapter 3:
Alternatives Considered

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ROUGHAN & O'DONOVAN

Chapter 3 Alternatives Considered

3.1 Legislative Requirement

Directive 2011/92/EU (as amended by Directive 2014/52/EU), Article 5(d) provides that the information to be provided by the developer shall include "*a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment*". The chapter has identified alternatives which were considered during the project development and the reasons why the proposed method was chosen.

3.2 Project Appraisal

During the development of the masterplan design for Trinity Wharf, various design options were considered for each element of the works. The following alternatives have been considered:

- Base Case:
  - Do-Nothing or Do-Minimum
- Do-Something including:
  - Alternative layouts; for buildings, marina, etc.
  - Alternative engineering solutions; site access, sea wall, etc.

3.3 Study Area

Trinity Wharf has been identified by Wexford County Council (WCC) as a key development site as part of the town's economic development and urban regeneration.

The identified area of land for development is a brownfield site, approximately 3.6 ha, located at the southern end of Wexford's Quays. The site consists of reclaimed land that extends into Wexford Harbour and was gradually reclaimed, with the northern part reclaimed around 1832. The site which has since been used for a number of different industries including a dock yard, bacon processing plant, iron works, car assemblers and electronics plant. It has been derelict since the closure of Wexford Electronix in 2001 and is now partly overgrown with some remnants of demolished structures remaining.

Plate 3.1 Image of existing site from south

The footprint of the proposed development also requires the development of a section of vacant, brownfield site between Trinity Street and the Dublin to Rosslare Railway

line which was also used for industry in the past and is currently owned by Wexford County Council. This area will form the new access point into the Trinity Wharf site directly from Trinity Street. There is currently no junction on Trinity Street to service the existing access to Trinity Wharf, therefore alterations to the existing road layout on Trinity Street will be required to accommodate a signalised junction into the Trinity Wharf site via a new access south of McMahons Hardware. Paul Quay carpark is an existing carpark to the north of the site along the quay front which is also owned by Wexford County Council. Modifications will be required to this carpark also to accommodate the tie-in of a boardwalk proposed as part of the proposed development, while a marina will also cover an area to the north of the Trinity Wharf site. The total site area to be developed is in the region of 5.47 ha.

As stated in Chapter 2 of this EIAR, Section 4.3 of the Wexford Town and Environs Development Plan 2009-2015 (as extended) identified Trinity Wharf as a Key Opportunity Site for development, being suitable as a town centre site and being "*of a scale that they have significant capacity for redevelopment and represent significant opportunities to facilitate enterprise and employment opportunities. In order to encourage the redevelopment of these sites it is essential to create a development momentum sufficient to stimulate market confidence*".

Furthermore, it also presents an opportunity to redevelop a previously industrialised site and to replenish jobs lost to the locality since the site was vacated in the early 2000s.

3.4 Do-Nothing Scenario

The 'Do-Nothing' scenario represents the minimum intervention, which acts as the basis against which alternatives and options are appraised. The existing scenario has been outlined in some detail in Section 2.4 of Chapter 2, which is preceded by the need for the proposed development in Section 2.3.

At present the current site is derelict and brownfield and has been temporarily fenced off to prevent unauthorised access. The brown-field nature of the site, its restricted access requiring the crossing of a live rail line, the presence of contaminants including some asbestos containing material, its proximity to deep water and its dilapidated state, with a number of partially demolished structures (including the old sea wall) mean that the site is currently unsafe for public use. This signifies that a 'Do Nothing' scenario would mean leaving the site as being a risk to public safety in the case of un-authorised access or anti-social activity.

The Do-Nothing scenario would also mean that contaminants within the site would remain susceptible to leaching in the absence of a surface water drainage system. The crumbling sea wall would also continue to degrade gradually over time as a result of coastal erosion and rising sea levels. The Do-Nothing scenario would essentially result in a site identified as a 'Key Opportunity Site' within the town centre remaining as a degrading brownfield site, resulting in a missed opportunity to develop the area into a vibrant mixed-use area which would attract investors and employment opportunities to the area and to Wexford Town.

A 'Do-Minimum' option would involve making the site safe by habilitating it for public use. This would involve removing asbestos containing material, clearing the debris and creating a safe access which does not involve crossing the railway line bounding the west edge of the site. Dilapidating structures including the sea wall would also have to be upgraded to preserve the site while making it safe for public use and to

protect it from coastal erosion in years to come. While this option would make the site safe, it would not release the potential of the site which was once home to the biggest employers in Wexford Town.

Both the Do-Nothing and Do-Minimum options involve potential for anti-social behaviour and will result in the brownfield site remaining as a site with high potential in a key location being under-utilised. The development of the site is therefore seen as the preferred option to release the potential of the site which includes protection against the coastal location and impacts of climate change, while providing high-quality public realm areas including a boardwalk, public plaza, marina and coastal walkway for members of the public to enjoy.

3.5 Alternative Sites Considered

The Trinity Wharf site is a 3.6 ha waterfront site at the southern end of Wexford Town Centre. Formed on reclaimed land, it is a disused brownfield site of substantial size, located within 5 minutes walking distance of the main retail and commercial core area in the town centre. The site is also highly visible from the town centre quayfront area and has been identified as a key development site as part of the town's economic development and urban regeneration.

While it is believed that Wexford town offers a very attractive environment for international companies seeking to locate in the county or for existing companies looking to expand, in addition the successful history Wexford has had in growing the international companies established here such as Waters Technology, BNY Mellon, Zurich Insurances, etc., the flow of new investors has been modest over the last number of years. It is considered that part of the difficulty has been the absence of suitable property solutions to meet investors' expectations and that it is essential to make available a range of suitable options for companies considering Wexford as a location to invest.

Because of Wexford's historic pattern of development, there has been very limited scope in the past to provide large-scale office space in the town centre. Instead recent commercial office development has been mainly car dependent suburban solutions such as single use business parks adjacent to industrial or retail parks. However, modern business trends are rapidly changing with the accelerating technological shift to innovative knowledge-based sectors developing new technologies, start-ups and creative services (including financial-technology, software and systems development, etc.) These businesses are attracted to high quality urban locations where they can cluster, create synergies, where people can interact and think creatively, with an easy walk to high quality amenities, uniqueness of place, and a broad range of town centre uses all providing a high quality of life for employees.

This is recognised by Government Policy documentation that emphasise the importance of 'place-making' in all our towns to attract FDIs and create sustainable, balanced growth locally and nationally. Wexford, with its strong heritage, unique identity, urban character and variety already has much to offer.

In choosing a site for the proposed development, the original concept was for an economic development project that would provide substantial employment for the Wexford Town area and wider district and county. Consideration was given early in the project conceptual stage as to whether this project should be sited at a green field setting peripheral to the town, however it was decided that such a location would contribute to urban sprawl and could pose a threat to the existing town centre. It was

therefore decided that regeneration of a brownfield site such as Trinity Wharf would be a more sustainable development solution and would serve to complement existing town centre commercial and retail infrastructure.

The 'Wexford Quays Economic Action and Spatial Implementation Plan', was prepared in 2017 to address the future development of the Wexford Quays area. This Plan identifies Trinity Wharf as the key opportunity site with the potential to attract these types of innovative, growth businesses by developing Trinity Wharf as a significant new urban quarter to the town centre, where companies can cluster together and where necessary infrastructure costs can be shared.

Wexford County Council identified that a development strategy for Trinity Wharf as a mixed-use urban quarter is the essential first step in positioning Wexford as an attractive location for business.

3.6 Previous Planning Permissions

Planning permission was granted by Wexford Borough Council in 2006 for a mixed-use development proposed for the Trinity Wharf site. The application (Ref: W2006025) by Deerland Construction Ltd. was subsequently amended to include further landtake under an additional planning application (Ref: W0006042).

The permission was granted for a mixed-use scheme (retail, residential, hotel, office, leisure (including cinema), bars, restaurants, childcare facilities, community facilities, car parking, servicing and ancillary uses and spaces) with a gross floor space of 119,342 sqm approximately (plus a multi-storey car park for 1844 no. cars) on a site of 7.08 ha. approximately comprising lands at Trinity Wharf, Townparks (off Trinity Street) including an adjoining foreshore/ harbour area of 2.4 ha approximately.

The project included demolition of existing buildings on site and construction of a linkage platform/ entrance plaza from Trinity Street to the site, with a bridge over of the rail line to provide access to the development. The development included the reclamation/ infill of a 2.4 ha foreshore/ harbour area; the construction of 8 no. buildings (ranging in height from 2 no. storeys up to 14 no. storeys above quay level) and ancillary development.

Building no. 1 was a predominately five-storey building with a higher element for the office block (seven-storeys, which comprised five-storeys of offices above the two-storey retail structure). Building no. 1 incorporated retail, non-retail services, office, leisure, community facilities, and carparking facilities comprising; two-storey shopping mall of 31490 sqm gross retail floor area approximately; creche (657sqm); multipurpose community hall (1217sqm); 6 no. screen multiplex cinema (4708 sqm); management suite and five-storey office (11233sqm); and a three level multi-storey car park (with roof deck parking above) over the two-storey retail, providing 1844 no. car parking spaces (55047sqm).

The residential element of the development was to consist of 6 no. apartment blocks with an aggregate total of 266 no. residential units. Five of the residential blocks ranging between six to nine storeys and the sixth block of primarily eight to nine storeys with a fourteen-storey landmark feature tower element.

Also included was the construction of a 282 no. bedroom hotel ranging in height from two to thirteen storeys; plant and ancillary structures located throughout the site, 3 no. single level cafe/ bar units; feature glazed canopy structures to the Trinity Street

entrance plaza; extension of the quayside roadway and pedestrian pavement, landscaping and the provision of statuary; internal roadways and paths; 157 no. surface car spaces at ground level; on-grade LPG and gas storage facility (located beneath entry/ access deck structure); and all other associated site excavation and site development works above and below ground and foreshore.

Revised site access arrangements were provided for via a new signalised junction at Trinity Street, opposite Fishers Row and by a new road way and associated access ramps.

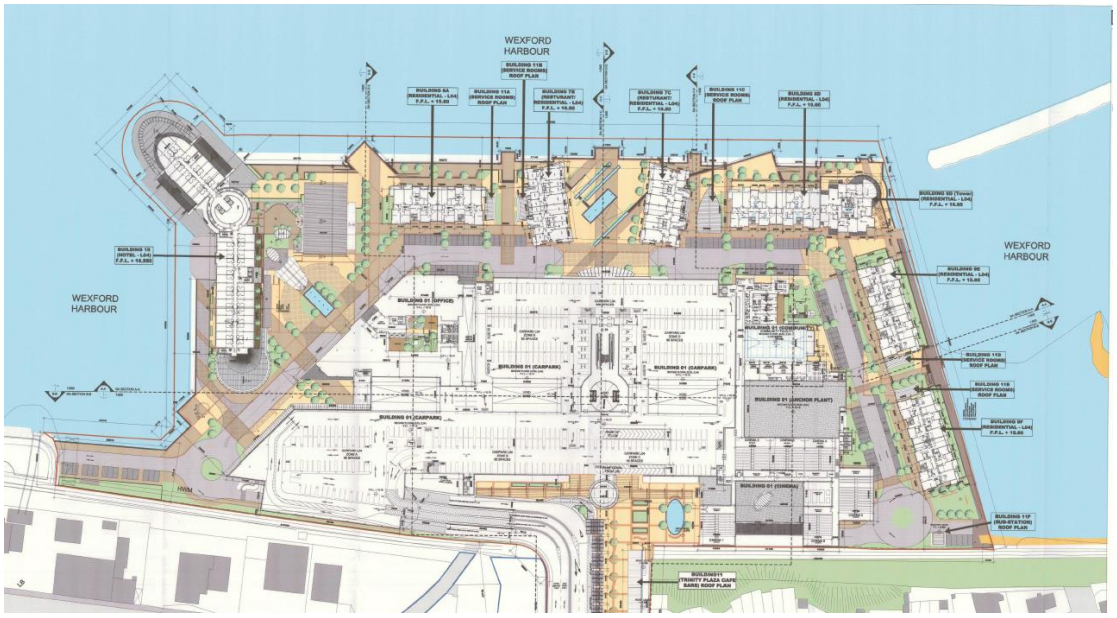

Plate 3.2 Deerland Construction Ltd. Site Layout

A further amendment to the planning permission was sought in 2008 to increase the site area by 1.53ha to 8.61ha. The amendments comprised; the construction of a 120 no. berth floating seawater marina, associated gangways and breakwater; a reclaimed staging area with new boat launch ramp and boat/ car parking area (10 no. car and boat trailer spaces and 12 no. car spaces); refuelling pier and associated fuel storage tanks; sewerage pump-out facility and service connections; a 2-storey marina facilities building and club house with associated service connections; all associated piling works and reclamation works (3475sqm); a revised road layout, and hard and soft landscaping works. This application was withdrawn in 2009 following appeal to An Bord Pleanála.

The Trinity Wharf site was purchased by Wexford County Council with planning permission for the Deerland Construction Ltd Proposal (Planning Refs: W2006025 and Ref: W0006042) as above, still active. Wexford County Council decided not to proceed with the active application as it did not represent the Council's ambitions and objectives for the lands.

Plates 3.2 and 3.3 show the site proposed layout and footprint of the Deerland Construction Ltd. application (red line boundary) in contrast to the existing landside Trinity Wharf site. The previous development was considered as an alternative in the development of the Trinity Wharf Masterplan, however as above, the application did not represent the Council's ambition and objectives.

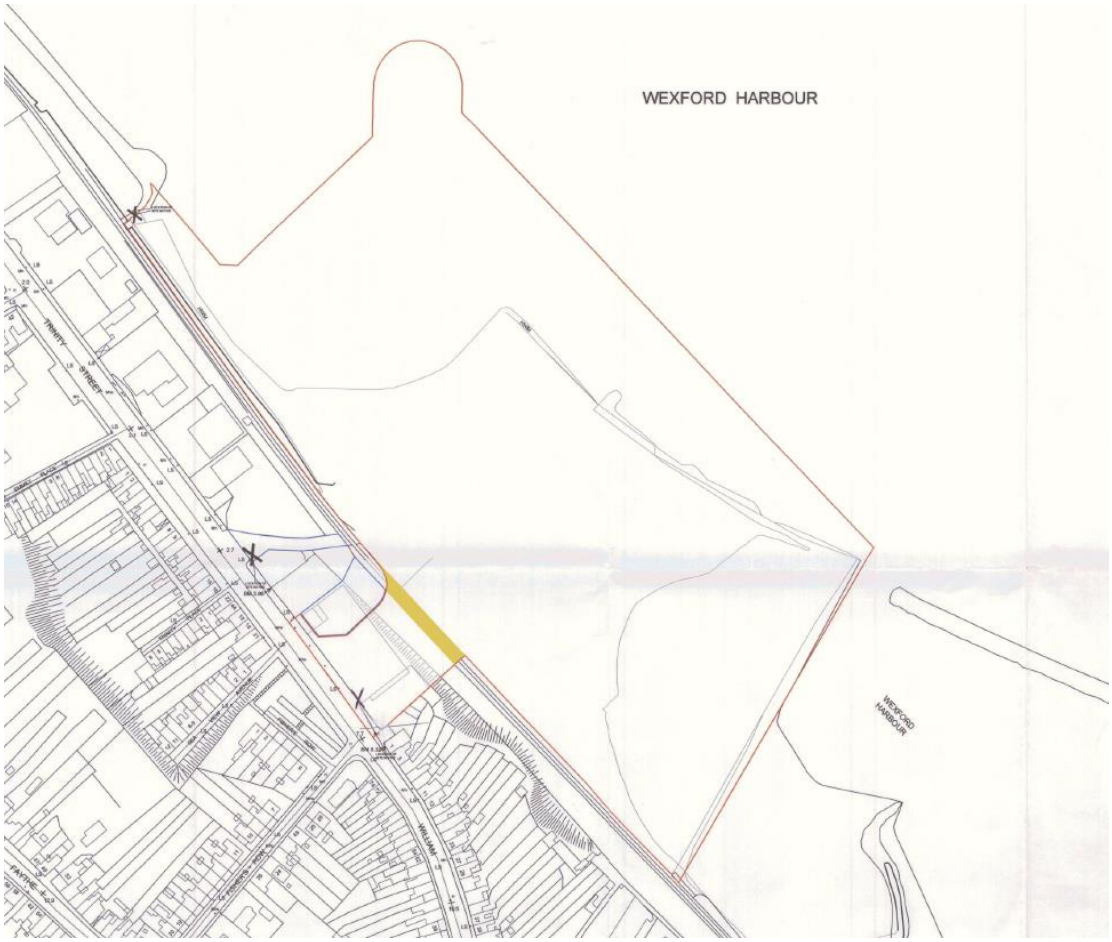

Plate 3.3 Proposed footprint of Deerland Construction Ltd Proposal

The proposed Trinity Wharf development is a mixed-use development similar to that proposed previously however, it has a commercial focus as opposed to the predominantly retail aspect of the previous development and is more conservative in scale. The proposed boardwalk will provide a pedestrian link to Paul Quay whilst requiring only marginal landtake, while the proposed marina is also almost half the size of the marina proposed for the site in 2008, with a capacity of 64 compared to 120 no. The reduced scale of the proposed development will have reduced traffic volumes and will allow the development of the site at a smaller scale, reducing the footprint and impact on the SAC by requiring less landtake and foreshore area to be developed and avoiding the requirement for dredging.

3.7 Alternative Layouts Considered

This section provides a broad description of each alternative layout considered, and the key issues associated with each, showing how environmental considerations were taken into account for deciding on the selected option.

3.7.1 Initial Site Studies

Initial site capacity studies carried out as part of the site assessment of Trinity Wharf for the 'Wexford Quays Economic Action and Spatial Implementation Plan' established a potential quantum of approximately 50,000m^2 with a range of buildings and uses in a high-quality public realm setting, hard and soft landscaping, creating an urban scale with a range of building heights generally around five to six-storeys with an overall

building height of approx. 20m, with two two-storey pavilion buildings at the northern and southern ends of the site.

Based on this layout, two initial site planning options were explored:

- **Option 1** with parking at one level across the entire site and a podium for all the buildings and spaces above. This indicated approx. 750 spaces could be accommodated on site.
- **Option 2** considered all buildings accessible at ground level with approx.120 surface parking spaces.

Option 1 was considered complicated with higher infrastructural costs, including potential excavation for basement/under-croft works, duplication of vehicular movement with vehicle ramps to allow taxi-drop off to building entrances and generally a more car-oriented design and poorer quality of urban design.

Option 2 was preferred as could be more easily developed in phases, with more efficient infrastructure, a pedestrian-friendly shared streetscape and public realm, and better integration with the surrounding context, and consistent with the objective of Wexford County Council to encourage and promote sustainable, active movement, particularly walking and cycling.

Option 2A further explored the location of uses, urban space and building form and massing. This included a study for a tall landmark hotel in the northern part of the site looking towards Wexford Quays, a residential building looking out onto Wexford harbour and five office buildings, three located along the railway line and two on the south-eastern part of the site. In this option, to allow more public space, the building footprints were smaller – which was less efficient – and building heights ranged between five and twelve-storey.

These studies helped establish site planning principles. For example, the idea of the taller building was to explore providing a distinctive landmark for Wexford as a destination at the end of the Quays, extending into Wexford harbour. However, it was concluded that the overall massing of the building would neither provide an iconic 'landmark' or the type of efficient floorplates sought by hotel operators, etc.

Instead it was decided to progress a more human-scaled design approach with a cluster of well-designed high-quality buildings that form an overall coordinated 'ensemble' in terms of massing, materials and finishes, that read together and relate to the harbour context. This informed the overall light and neutral colour palette for materials and finishes that relate well to both the sky and water.

Key objectives for the proposed development included:

- establishing a sequence of spaces relating the development with the surrounding context to encourage active movement along the Quays and into the main town centre area;
- creating a high-quality public realm with a multi-purpose use within the development;
- providing functional building floorplates to meet modern user requirements and connectivity from within the development with the waterfront around the site;
- locating the residential component in a quieter, more private area away from busy active areas for the amenity of residents;

- specifying an overall palette of materials and finishes, including those for the boardwalk, sea wall and water's edge, that relate to and enhance the context and setting of the development.

3.7.2 Relationship with the Surrounding Context

The relationship of the site and any development proposals with the surrounding context was a key design consideration from the outset. In analysing the site context, the following were identified as particularly important:

- the views of Wexford town from Ferrybank, particularly the scale and character of the quay-front as well as the overall setting,
- the spatial sequence and experience while moving along the quay-front towards Trinity Wharf from Wexford Bridge,
- the connection between Trinity Wharf and Trinity Street, and,
- the relationship of Trinity Wharf with Goodtide Harbour and the residential area overlooking the site to the south.

Views of Wexford Town from Ferrybank

Looking across the River Slaney from Ferrybank provides a panoramic view of Wexford town centre and quays leading out into Wexford harbour. With the broad river, the scale of buildings in the town centre is generally low and framed by the ridge-line of the hills behind, with just a few significant landmarks breaking above with buildings and boats along the quays.

The scale and massing of buildings changes along the quay-front. On the northern quays, from the bridge as far as the Crescent, the urban scale is fine-grain with a varied mix of buildings ranging in age, height, materials, finishes and quality.

The buildings around the Crescent are low, mainly two-storey and comparatively domestic in scale. From the Crescent to the Talbot Hotel, the overall scale, plot size and massing is considerably larger than that of the northern quays, with several modern 4 to 6 storey buildings having extensive frontage, such as the Talbot Hotel Apartment Building and Trinity Street apartments, which is set slightly apart.

From this point the character changes significantly. The ridge-line is much lower and extends out into the harbour as a promontory. At this point, several large industrial buildings dominate the ridge-line. Sitting below these are mainly low-scale 2 to3 storey residential buildings. There is a band of green planting between these and the waterfront. Trinity Wharf is located at the point where the shoreline changes from a hard edge to green landscaping, although this is in part due to the demolition of the industrial buildings on Trinity Wharf. In its current state, Trinity Wharf has very little presence within the overall wider vista of the harbour, and any development will have a significant impact. For this reason, any development needs to be of very high quality in adding to the harbour context.

Rather than a tall landmark structure, the initial site studies identified that a human-scaled design approach with a cluster of well-designed high-quality buildings that form an overall coordinated 'ensemble' on the waterfront would work best.

In terms of massing, an overall 5 to 6 storey height of buildings relates the development to the existing urban scale of the southern section of the Quays and with the ridgeline behind the site. This would also reduce the impact of the existing industrial buildings on the ridgeline.

The works associated with rebuilding the sea wall around the site, and making a connection with Paul Quay, read visually as an extension of the town's quay-front, with a coordinated palette of materials and finishes with a neutral light-colour that harmonises the development with the surrounding natural context.

The Spatial Sequence of Wexford Quays

The changing view and experience while moving along the quay-front towards Trinity Wharf from Wexford Bridge was a key consideration from the outset of the design process.

The contrast between the tight urban pattern of the historic town and the expansive views across Wexford harbour from the wide quay-front are a unique feature of Wexford, and most evident along the northern quays (Commercial Quay, Custom House Quay). Along these quays, the Trinity Wharf site is currently not visible, because it is largely screened by the Protective Arm. However, it was anticipated that buildings located at Trinity Wharf would have a visual impact.

Moving past the Crescent along Paul Quay, the drama experienced by the contrast between the historic town and the open harbour weakens, due in part to the change in scale and grain of the buildings along Paul Quay, but also by virtue of the change in use of the quay from public realm to car parking, and the existing view of the Trinity Wharf site with its neglected appearance.

The relationship with the town centre is very much diminished along Paul Quay car park, where there is very little urban presence other than the backs of industrial sheds and warehouses. At this point, the existing Trinity Wharf site has a dominant presence, obscuring much of the wider harbour, with the more attractive views looking across the harbour.

The challenge was how to transform this area into a meaningful space and enjoyable part of the waterfront experience. The urban design response was:

- Firstly, locating the hotel along the Trinity Wharf waterfront facing towards Paul Quay would help draw people along the quays, by providing an interesting destination with active uses – a restaurant and bar on the lower floors and bedrooms above with balconies looking towards the town,
- Secondly, designing the boardwalk as a curved sculptural element, unique to Wexford, that people will find attractive and enjoy using, and
- Thirdly, reconfiguring the adjacent sea wall so that it ties visually with Paul Quay.

T
he outcome is that the area between Paul Quay and Trinity Wharf has its own identity and becomes part of the varied spatial sequence connecting Commercial Quay, the Crescent, Pail Quay, the Boardwalk, and Trinity Wharf.

Trinity Wharf and Trinity Street

A key consideration of the design process was how the proposed development should address and relate to Trinity Street.

The character of Trinity Street varies, with predominantly large retail warehouse type units at the northern end, and two-storey 19th century terraced housing (opening directly onto the street with on-street parking, and with several laneways from Emmet Place) on the western side of the street. Southwards, it meets William Street and Fisher's Row.

However, the overall character is utilitarian and dominated by vehicles, with commercial warehousing, wide roads, overhead wires and security fencing. These is very little planting or amenities on the street for pedestrians or residents.

The existing development site has very little presence on Trinity Street other than through a few gaps between buildings on the east side of the street. The only existing access is via a narrow strip of land between Trinity Motors and McMahon's Building Supplies. The exception is at the temporary gap site on Trinity Street owned by Wexford County Council which, since the former warehouse building was demolished, offers views of Wexford Harbour. The proposed buildings are set back approx. 70m from Trinity Street and are largely screened by existing buildings, except at the entrance and directly opposite the temporary gap site.

At an early design stage it was determined that a new vehicular entrance serving Trinity Wharf would be required. Options were limited - an entrance off Trinity Street at the gap site owned by Wexford County Council was the most practical option, providing a gradual slope to a new railway level crossing, with least impact visually and in terms of engineering works.

The proposed new entrance and junction are designed to be modest in terms of vehicular space, with wide pavements and good quality finishes. Public realm measures include repairing the existing street frontage with attractive screen planting, improving the overall appearance and visual amenity of this part of Trinity Street, and subtly integrating with the high-quality public realm associated with the new entrance into Trinity Wharf. The proposed design therefore improves the urban quality, visual appearance and amenity of the street and provides a direct link from Trinity Street to the waterfront.

Goodtide Harbour and the Residential Area to the South

There are views of the Trinity Wharf development site from the end of Batt Street and Harbour View, both of which provide elevated vantage points overlooking Goodtide Harbour and the southern part of Trinity Wharf.

The design approach for the Trinity Wharf site is that this informal quieter quality should be retained as a contrast to the more active areas of the proposed development. Proposed uses were explored, with a preference emerging for a residential apartment building with balconies and communal amenity space facing towards the harbour providing an appropriate level of activity and passive supervision, and which would complement the existing residential uses in the neighbouring areas.

The proposed rock armour to the sea wall to minimise wave refraction in this area also creates a 'soft edge' at the water's edge which visually ties the development with Goodtide Harbour.

The proposed design recognises that views from the rear of the terraced housing along William Street overlook the Trinity Wharf development site and Wexford Harbour. The height of these properties are approx. 6-8m above the existing ground level, which equates to approx., two storeys of the residential building and multi-storey car park. It was recognised these buildings would need to be exceptionally well-designed and pleasing to look at with trees and natural landscaping to reduce the visual scale of the buildings.

Particular consideration has been given to the elevational design of the car parking structure. It is proposed that it be clad in perforated, metal, rippled cladding so that

internal views and lights are diffused, similar to the Inselhalle car park in Lindau, Grmany.

3.7.3 Site Design Principles

Urban Design

There are two main routes that bring people into the proposed Trinity Wharf development - along the waterfront from Paul Quay, and from Trinity Street. Both of these arrive in the northern part of the development site, and it is here that the main public activities and attractions are focused.

A large public space is proposed as the main focal point, connecting with the arrival space from the boardwalk, and the entry route from Trinity Street. The main 'high frequency' active uses - restaurants/cafes, hotel entrance and cultural/performance centre are located around this space, and the scale of the buildings around this space is designed to provide a sense of enclosure.

The arrival routes and main space are designed as a series of connected spaces, with uses, building forms and public realm all designed to provide natural wayfinding and orientation. For example, the mixed use restaurant/cafe building is located where people will naturally converge and congregate to enjoy the waterfront or the events in the main space.

The southern part of the development site is more suitable for residential and similar types of use that enjoy a 'lower frequency' calmer, quieter environment. The connecting streets and routes are designed with uses that provide a steady flow of pedestrian activity and with an appropriate level of passive surveillance.

A key objective for the site is to create a high-quality public realm with uses and activities that attract people. Because of the exposed site location, it was identified that the most active public spaces and uses would best be located towards the centre of the site with larger buildings around the waters-edge. In contrast, the main waterfront is more exposed and offers people the opportunity to enjoy and appreciate the elements and views.

Most activity, building entrances, vehicle drop-offs, etc. are located facing into the central area rather than on the exposed waterfront frontage, and this area has a softer landscape treatment in contrast to the more exposed, hardier environment on the Wexford harbour waterfront.

Access and Movement

The movement and public realm design strategy for Trinity Wharf as an urban quarter is to prioritise and promote active movement and shift away from car dependency.

With its proximity and connectivity to the town centre, the proposed development is designed based on sustainable active movement principles that prioritise walking and cycling. The proposed boardwalk is a key component of this because it creates a direct connection with the town centre and the main public transport hubs at Redmond Square.

The Trinity Street entrance is designed as an attractive landscaped street to enhance the public realm. A new signalised traffic junction on Trinity Street forms the main vehicular entrance to the development and continues across the proposed new level crossing. At this point people arriving by car are directed by the design of the street

layout to the proposed multi storey car park. They can also turn onto the clearly indicated shared surface route which circulates around the site for drop-offs/pick-ups. This layout and approach means that vehicular traffic within the development is minimised to drop-off, service and emergency vehicles, so that the main spaces can be designed as low-volume 'shared surfaces'. The shared surface materials and finishes clearly indicate to vehicles that they need to drive slowly and yield to pedestrians and other people.

Universal design principles are embedded in the design approach, in accordance the NDA Built Environment 'Shared Space' principles. The shared surface one-way route from the railway crossing circulates around the site and back to the entrance to the car park, allowing drivers to park after dropping off passengers or exit back to Trinity Street. This circulation route provides access to drop-off areas and short-term parking areas close to building entrances for taxis and people with disabilities. A coach set-down area is provided at the hotel entrance.

All routes are designed to allow for service with waste collection points located in buildings with easy vehicular access. Emergency access for ambulance and fire tenders has also been provided, including restricted emergency access along the waterfront cycle/footpath, between the car park and cultural/performance centre and around the hotel to maximise access around all buildings. All these routes create a varied and very permeable pedestrian friendly movement network throughout the proposed development.

3.7.4 Building Services

The following section describes the two options explored during the preliminary design phase for the plant arrangements for energy provision to the buildings.

The following two options were explored for this:

- Centralised Plant
- Decentralised Plant

Centralised plant arrangement consists of a central energy centre, potentially located near the site entrance, which would contain the main plant for providing energy to the buildings. Each building would be equipped with sub-plantrooms with ancillary plant consisting of heat exchangers/pump sets. The centralised energy centre would provide district heating, cooling and water services while electricity and ventilation systems, would still be provided locally at each building.

Plate 3.4 illustrates a possible Centralised Energy Disruption arrangement.

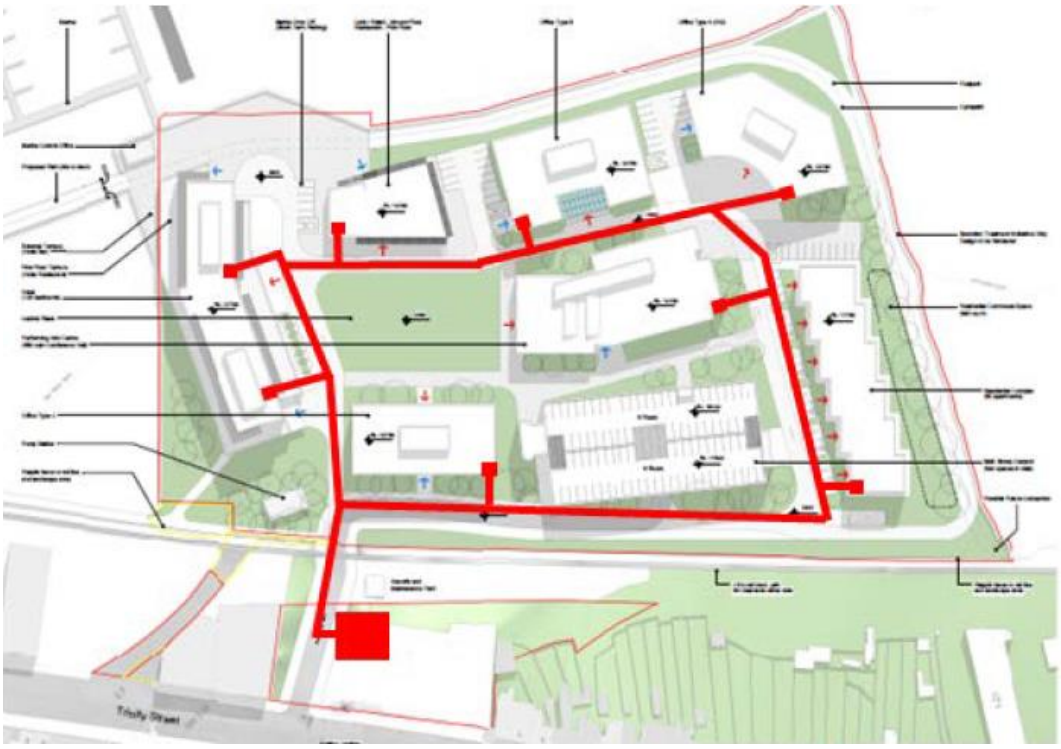

Plate 3.4 **Possible Centralised Energy Distribution (Note: the site layout in this plate is taken from the conceptual design stage and contains elements of the project including the site boundary which have been updated as part of the final design)**

The alternative option of a Decentralised plant arrangement would consist of individual plantrooms located in each building in a conventional manner. Plate 3.5 illustrates the Possible Decentralised Energy Distribution arrangement.

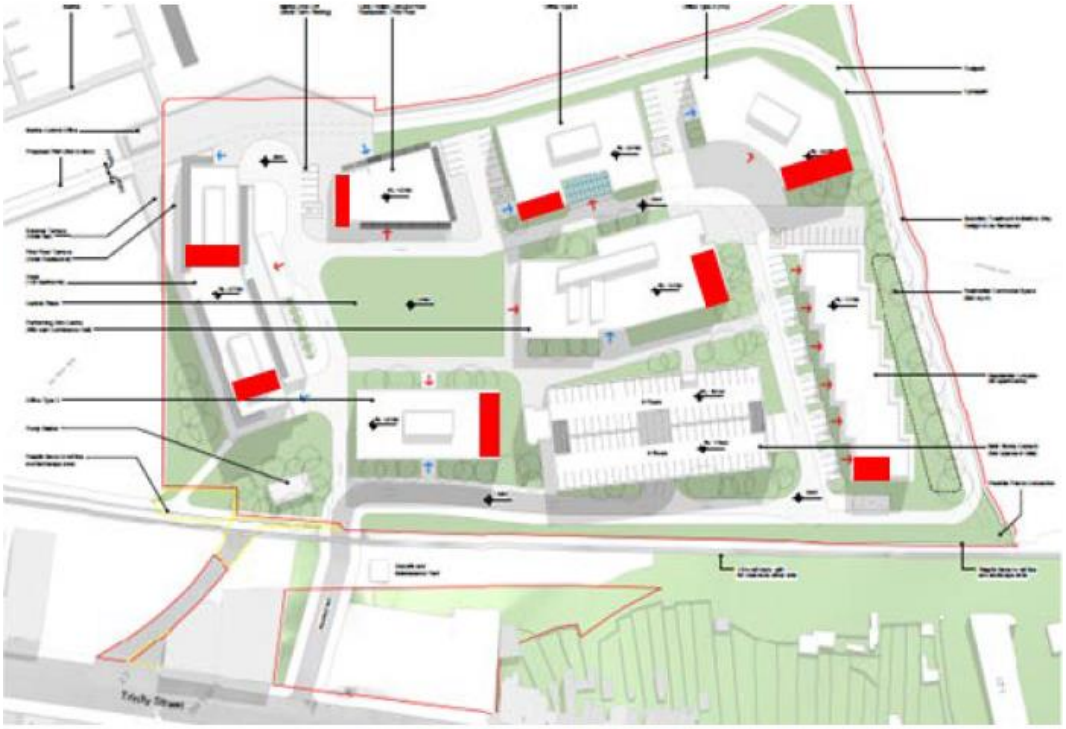

Plate 3.5 **Possible Decentralised Energy Distribution (Note: the site layout in this plate is taken from the conceptual design stage and contains elements of the project including the site boundary which have been updated as part of the final design)**

The following were identified in advantages of using a centralised plant over a decentralised plant:

- **Capital costs** - A centralised arrangement enables a more diversified approach to plant sizing requirements, resulting in lower overall costs. Larger plant items for the overall development would also cost less than smaller individual plant items as would be required for each building. Space requirements are also maximised for individual buildings (i.e. nett lettable floor area to offices) as plant space relocated to energy centre.
- **Energy** - Improved efficiency of performance can be achieved through the use of a centralised plant arrangement.
- **Near-Zero Energy Building (NZEB)** - Improved efficiency of performance can be achieved through the use of a centralised plant arrangement.
- **Maintenance** - An energy centre would ensure single point of maintenance for all main heating plant; possibly located beside Facilities Manager office etc.
- **Flues** - Boiler flue emissions centralised to one location and remote from buildings/ occupants.
- **Noise** - Plant and associated noise located centrally; also remote from building/ occupants.

The following were identified as disadvantages of using a centralised plant over a decentralised plant:

- **Management** - Operation and maintenance for Energy Centre would be required to be undertaken by a management company for the site as a whole, including service charge or heat metering/ charging to individual buildings.
- **Upfront Capital Cost** - A potential Energy Centre and site infrastructure would require to be incorporated within Phase I of the development; albeit some plant (boilers in modular arrangement etc.) could be installed on a phased arrangement also.

While the centralised plant arrangement could provide improved efficiency of performance, given that the overall strategy for the development is that individual stakeholders will develop each part of the development separately, it was decided that the use of a decentralised plant system would provide greater flexibility for the development.

3.7.5 Public Realm and Landscaping

A Landscape Concept has been developed by Landscape Architects The Paul Hogarth Company for the Trinity Wharf Development to guide the arrangement of public realm design and landscaping arrangements for public areas of the development. Landscape proposals have been developed following site analysis, document review, client and design team briefings.

The following features were identified during site visit and were incorporated into the design:

- Views and points of interests within and outside the site;
- Materials within and to the edges of the site with Concrete, roughhewn stone and timber being prominent;
- The variety of 'emergent' vegetation was noted with significant meadow grass and wildflower species;
- The exposed nature of the entire site and sea water overtopping of land;

- Site features in the water (outside the site boundary) including stone beacons and former timber boardwalks; and,
- Existence of invasive species alongside the rail line.

Following the site analysis, a Landscape concept of 'Conversation between Land and Water' was developed to guide the creative practical development of proposals.

A range of tree species and vegetation to be included in the landscaping were looked at for inclusion within the Landscape Concept. While certain species were outlined by Irish Rail as to be used in adjacent to the railway line, where possible, native tree species were selected for the remainder of the site. The Landscape Architect worked alongside the Roughan and O'Donovan project ecologists to ensure that species lists to be included would have positive impacts on biodiversity within the site and would complement the nature of the existing site.

Public Realm proposals also took into account the features of the site and have designed the site to take cognisance of the existing character of the site. A greenway around the perimeter of the site will aim to capture the existing rocky nature of the site, and the connection to the water, as opposed to harsh finishes.

The design of the landscaping and public realm proposals have taken into account the ecology and current brownfield status of the site and have incorporated designs that will enhance the existing biodiversity and character of the site as much as possible.

3.7.6 Traffic Provisions

3.7.6.1 Main Site Access

The current access to the site is via an informal gated level crossing which is used for occasional authorised access. This crossing was identified at an earlier stage during the design development as not suitable for the main access to the site due to the geometric constraints of the road. The road is too narrow and due to the proximity of adjacent privately-owned site, the road could not be upgraded to conform with current road design standards. Plate 3.6 below illustrates the current access.

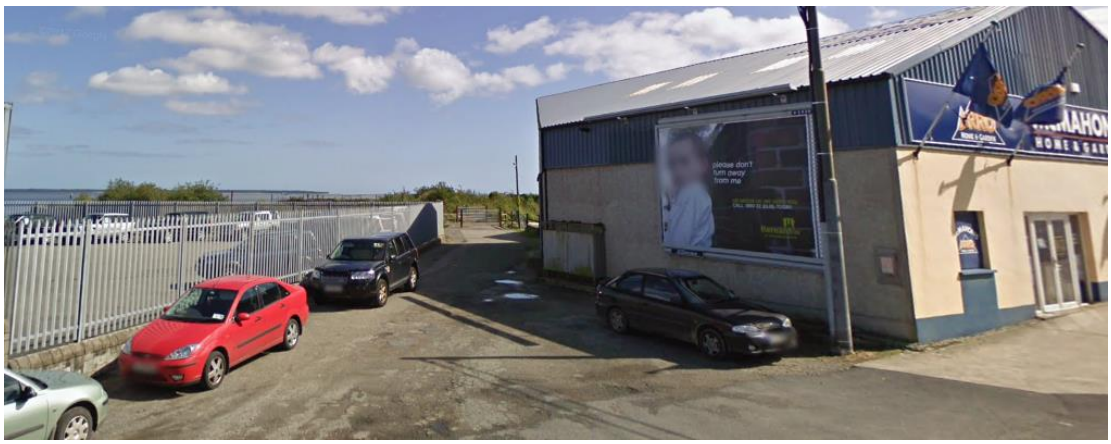

Plate 3.6 Existing Access Lane

The development site is bounded along its south-west edge by the Dublin to Rosslare Railway Line and therefore access to the site from Trinity Street must traverse this railway line.

The only option for the main site access was therefore restricted to be a new access road from Trinity Street leading across the railway line at a new location to the existing entrance.

The following two options were considered to traverse the rail line as the main site access. The principal factors considered here were the anticipated traffic flows versus the number of daily trains, cost implications, land take and environmental factors. Iarnród Éireann were consulted in consideration of both options.

At-grade Level Crossing Option (Option 1)

The first railway crossing option considered consisted of a standard level crossing with automatic signalised boom barriers. The benefits of this option are that the signalised level crossing has a lower land requirement and lower capital cost compared to Option 2 (described below). The traffic delays are considered moderated as the signalised barriers will activate for 3 minute durations, 8 times a day at off peak times, according to current train activity. This option would also be preferred in terms of noise and vibration and landscape and visual impacts due to the at-grade nature as well as the potential for Human Health effects, compared to an overbridge option as below.

Road Overbridge Option (Option 2)

The second railway crossing option consisted of a grade separated rail crossing involving the construction of a bridge over the railway with approach ramps. For this option, a 100m long ramp would be required within the site to slope up at a 5% grade and provide the 5m height clearance required over the rail line, requiring a significant amount of land to be used up within the site.

This option was considered unfeasible from an early stage due to the capital cost implications and the land take requirement within the proposed site due to the requirements of the approach ramp. This option would also have greater impact on local receptors due to the visual impact and elevated noise levels due to the required height of the road alignment. The benefits of this option are that the running cost would be less than the level crossing solution, separation between traffic and Iarnród Eireann land and the free movement of traffic over the rail line which would reduce delays. Finally, in order to provide an economically feasible development to meet the project objectives, the existing site area would need to be substantially increased by reclaiming areas of the estuary

Due to the significant land take required to construct an approach ramp on the development site and the increased impacts on adjacent properties, the at-grade level crossing was selected as the preferred solution. The site extension and the requirement for reclamation of lands within the estuary was considered likely to have significantly adverse effects on the Natura 2000 sites and the at grade option was selected as the preferred option.

3.7.6.2 Main Access Road

An access road is required to link the proposed development to the existing road network on Trinity Street which leads directly across the level crossing.

The cross section of the proposed access road is to be designed in accordance with the Design Manual for Urban Roads and Street (2011) and will typically consist of a 6m carriageway and 3m footpaths/cycle paths on both sides.

The lands available to the local authority and the levels of the proposed site have dictated that the access road must connect to the south-western section of the site.

The three alignment options considered for this road are described below. All three options involve the construction of a level crossing of the Dublin to Rosslare Railway line. As per Section 3.7.6.1, a bridge was ruled out at a very early stage due to the extremely difficult height differences, the amount of land required to get traffic back to ground level on the proposed site and the associated environmental effects on people and the Natura 2000 sites.

Alignment Option 1

Alignment Option 1 considered widening the existing access lane between McMahon's Home and Garden and Trinity Land Rover, to accommodate the proposed access road. The benefit of this option arises from the level difference between the site and Trinity Street being the most advantageous of the three options. This option was not considered feasible as an additional 7m strip of land minimum would have to be purchased on one or both sides of the existing access lane.

Alignment Option 2

Alignment Option 2 proposed a sinuous alignment connecting to Trinity Street just south of McMahon's Home and Garden building. While the benefits of this option include the land required being owned by the local authority and a desirable gradient being achieved on the entrance into the site, there are also a number of disadvantages associated with this option. Primarily this option would impact negatively on the approach to the development. The design of the proposed development has aimed to visually improve the appearance and visual amenity of this part of Trinity Street through an open and inviting entrance. This option would not offer views into the development from Trinity Street and would block any potential views of the sea for those entering the site. The location of the entrance would also bring users into the site to views of an office block as opposed to other options which lead visitors into the hotel entrance and public plaza area. Overall this option would appear to provide a somewhat unwelcoming, closed off entrance to the site.

This option would also sever the entire vacant plot owned by the local authority and would be detrimental to the future development of this site. In addition, the access road would bring traffic closer to the houses south of the vacant plot, with the site management building being located directly behind the adjacent gardens. Plate 3.7 below illustrates this option.

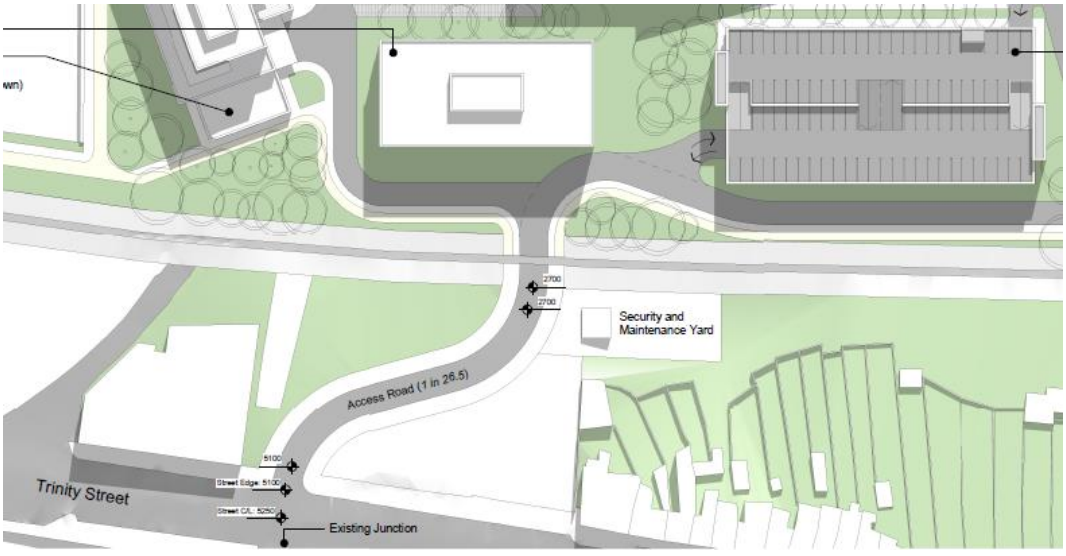

Plate 3.7 **Sinuous Access Road Alignment (Note: the site layout in this plate is taken from the conceptual design stage and contains elements have been updated as part of the final design)**

Alignment Option 3

Alignment Option 3 proposes a straight alignment into the site connecting to Trinity Street, immediately south of McMahon Home and Garden. This was chosen as the preferred alignment as the land required is owned by the local authority resulting in a reduced impact on the vacant plot compared to option 2. The disadvantage of this option is that longitudinal gradients over 5% are required between Trinity Street and the level crossing. Gradients over 5% are not desirable on urban streets where pedestrians are active, however this effect is mitigated due to the short length (50m) of the slope. Plate 3.8 below illustrates this option.

This option will provide those entering the site with an attractive and welcoming view down through the site with sights of the sea and while vehicular users will be directed towards the car park, pedestrians and cyclists will be led into the heart of the development via an entrance corridor, leading to the hotel, café/restaurant and public plaza area. This option will also keep the traffic using the access road further away from the adjacent houses on Trinity Street reducing any potential noise and visual impacts.

Plate 3.8 **Straight access road alignment (Note: the site layout in this plate is taken from the conceptual design stage and contains elements including the site boundaries, have been updated as part of the final design)**

There were no major environmental differences between the three road alignment options although the options with the steeper gradients would be expected to perform worst in terms of air quality and climate. The preferred option, Option 3, will provide a more direct route and a main corridor approach to the heart of the proposed development as a result of its straight approach. The views on approach to the site extending into Wexford Harbour will be visible and will connect the site users to the harbourside location and maritime history of the site as they enter into the proposed development from Trinity Street.

Trinity Street Access Junction

The selection of Alignment Option 3 involves the construction of a 4-way access junction with Trinity Street and Seaview Avenue. The following three junction types were considered;

Junction Type 1: Priority Junction

A junction capacity analysis indicated that a priority junction would operate with a maximum Ratio of Flow to Capacity (RFC) of 0.78 during peak hour traffic post development. A priority junction with an RFC of 0.85 or above is considered to be performing unsatisfactorily leading to long queues and excessive delays. This would also lead to increased air pollution due to queueing in an urban area. A priority junction would not adequately provide for pedestrians in a location where pedestrian activity is anticipated to be high.

Junction Type 2: Signalised Junction

A signalised junction was also assessed. A junction capacity analysis indicates that the junction will operate at 53.5% Degrees of Saturation (% DoS). A signalised junction is considered to be performing satisfactorily if the DoS is at or below 90%. The signalised junction will also include a pedestrian stage which will adequately accommodate for pedestrians in a safe manner. Therefore, this option was selected as the preferred solution.

Junction Type 3: Compact Roundabout

A compact roundabout was briefly considered but was deemed inappropriate for the anticipated traffic flows and the predicted pedestrian/ cyclist activity.

The Signalised Junction is the preferred option and has shown through the above assessments that it will operate satisfactorily, managing the traffic in the most efficient way, whilst providing safe crossing points for pedestrians and cyclists.

3.7.7 Marina Options

For the design of the marina, a series of preliminary conceptual marina options were created based on the coastal processes within Wexford Harbour. A Trinity Wharf Marina Feasibility Study (see Appendix 4.1) was prepared by RPS Group to assess the different marina options which could be included in the development and the environmental effects of each.

The following Conceptual Options were developed by RPS Group:

Conceptual Marina Option 1

This option is based on developing the north western side of Trinity Wharf to create an attached marina. Plate 3.9 illustrates an indicative layout of conceptual marina Option 1.

This option would achieve a suitable wave climate by constructing a series of floating breakwaters around the perimeter of the proposed marina to create a sheltered area of approximately 16,000m^2. This potential marina area could facilitate approximately 70 marina berths.

In order to create a minimum operating depth of -2.5m cd, it would be necessary to dredge and dispose of approximately 40,000m^3 of sediment material from the proposed marina area.

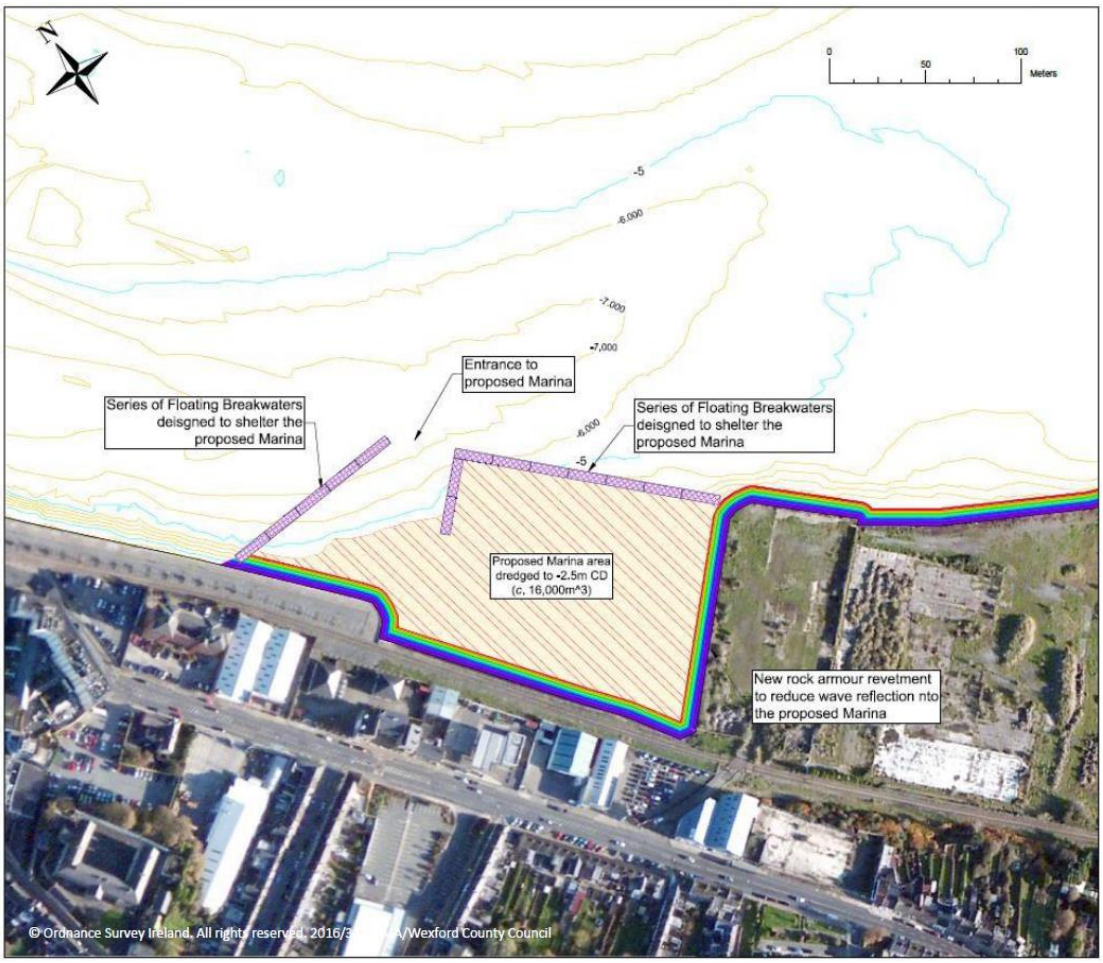

Plate 3.9 Indicative layout of conceptual marina Option 1

Conceptual Marina Option 2

Option 2 is based on developing the northern corner side of Trinity Wharf to create an attached marina. Plate 3.10 below illustrates an indicative layout of conceptual marina Option 2.

A suitable wave climate would be provided by constructing a series of floating breakwaters around the perimeter of the proposed marina to create a sheltered area of approximately 6,600m^2. This potential marina area could facilitate approximately 60 marina berths.

As this option is located on the northern corner of Trinity Wharf and projects into the deeper region of the Slaney estuary, to achieve a desired operational depth of -2.5m CD only c.650m^3 of material would need to be dredged. However, through strategically positioning vessels with smaller draughts in this area any initial dredging requirements can be completely avoided.

Based on existing hydrographic and bathymetric survey data it is likely that the littoral currents are highest in the area of the northern corner. As such, it is likely that this particular option would require less maintenance dredging relative to the other options presented.

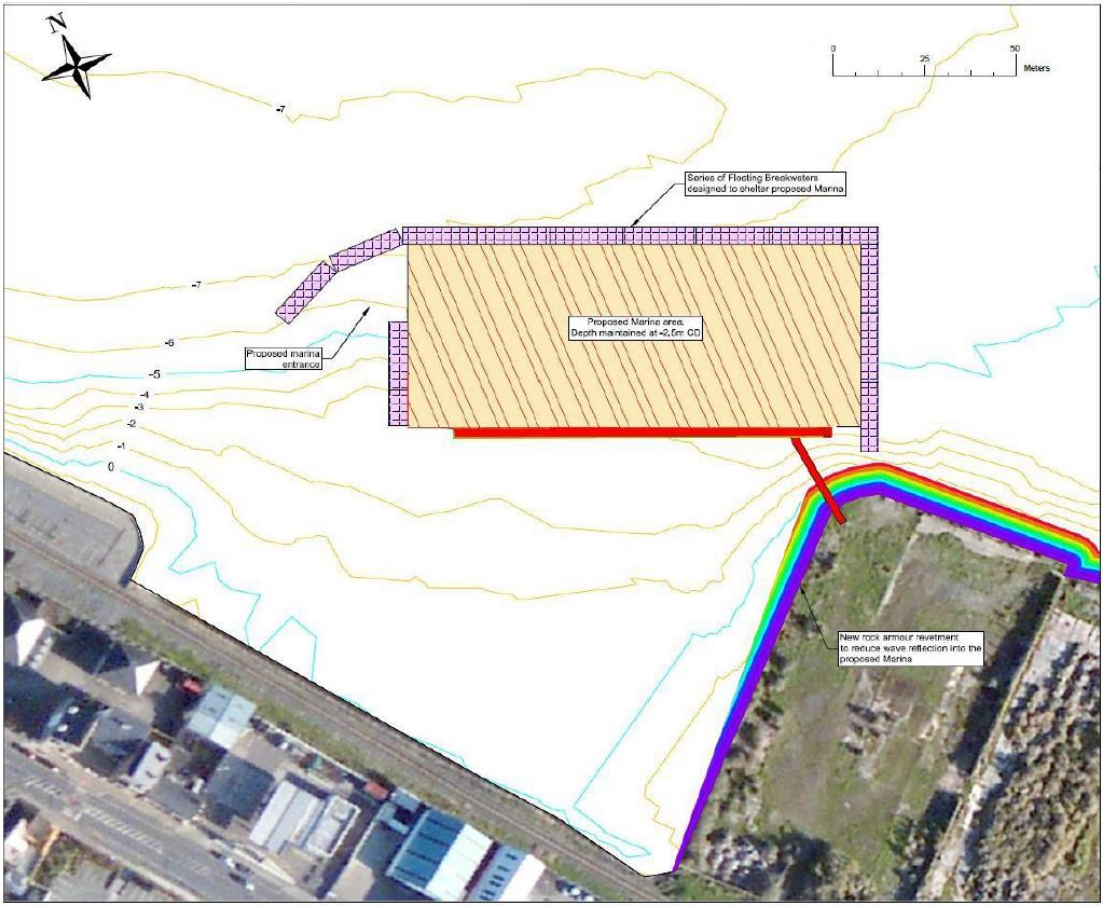

Plate 3.10 Indicative layout of conceptual marina Option 2

Conceptual Marina Option 3

Option 3 would involve constructing an appropriately designed rubble mound breakwater approximately 320m in length just beyond the north eastern boundary of Trinity Wharf. This would create a sheltered marina of c.18,000m^2 capable of facilitating approximately 100 berths.

To create the appropriate minimum operating depth of -2.5m CD it would be necessary to dredge and dispose of c.6,500m^3 of marine sediment.

Plate 3.11 below illustrates an indicative layout of conceptual marina Option 3.

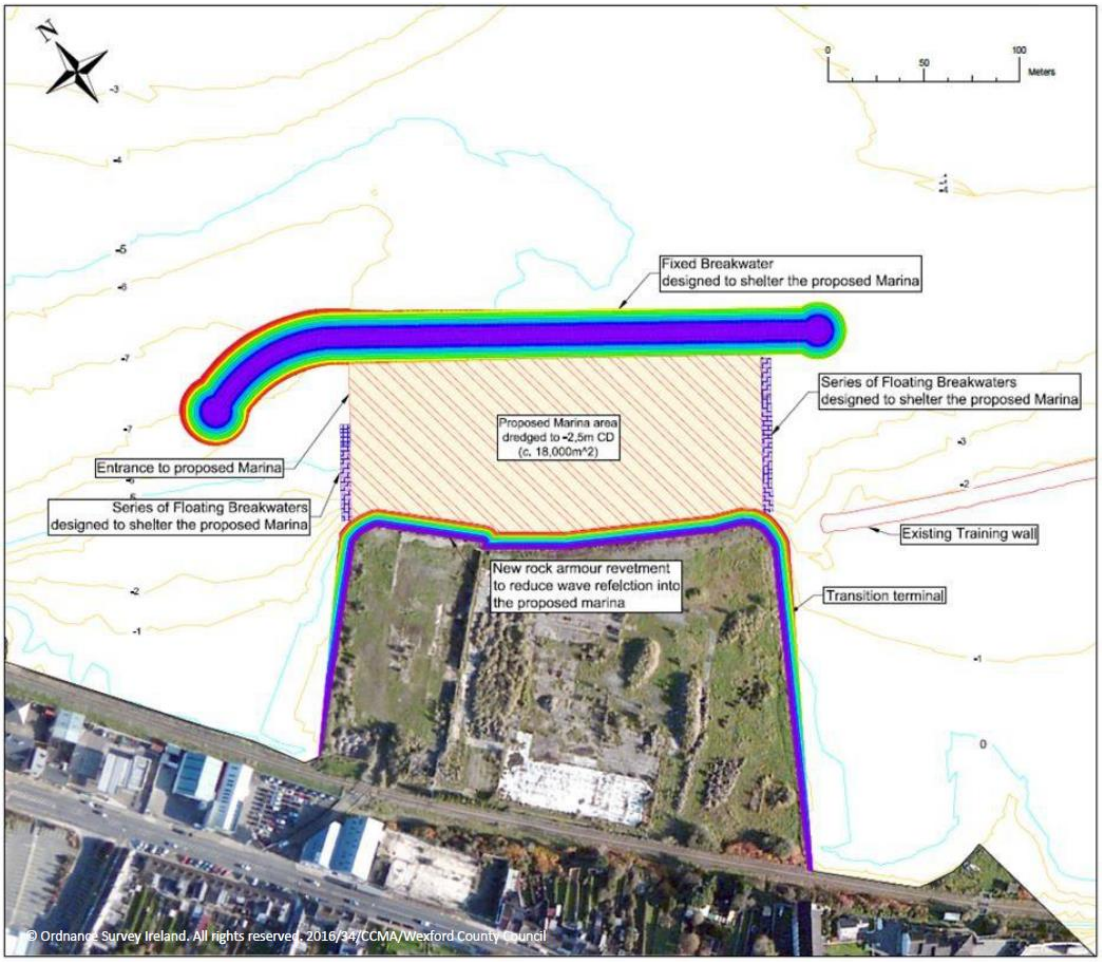

Plate 3.11 Indicative layout of conceptual marina Option 3

Conceptual Marina Option 3a

This option is almost identical to Option 3 but would involve constructing a series of floating breakwaters as opposed to using a fixed rubble mound break water to create a sheltered marina area of c.18,000m^2.

This option would require the dredging of approximately 6,500m^3 of marine sediment to achieve the desired operating depth of -2.5m CD.

Plate 3.12 below illustrates an indicative layout of conceptual marina Option 3a.

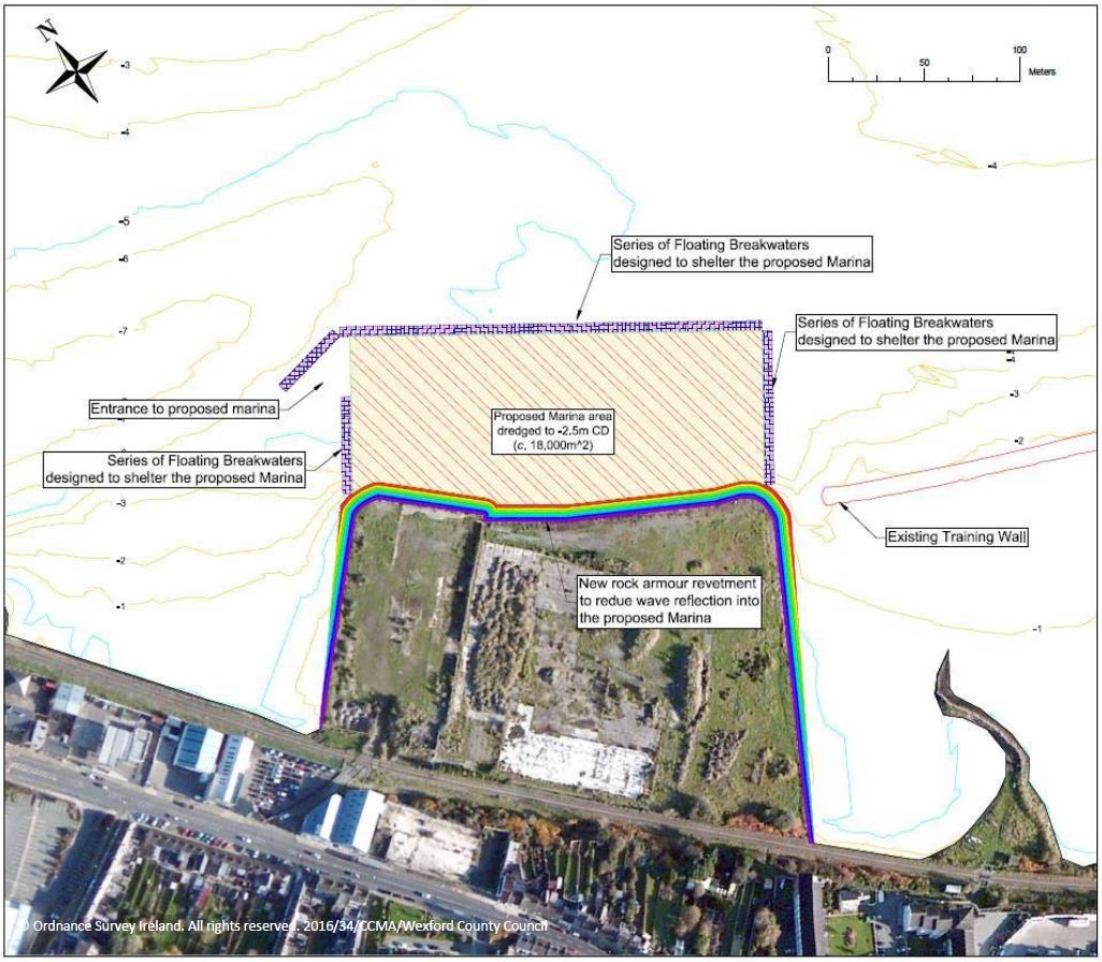

Plate 3.12 Indicative layout of conceptual marina Option 3a

Conceptual Marina Option 3b

Option 3b is similar to Option 3a but would involve reclaiming approximately 1,750m^2 of land to the north east of Trinity Wharf. This area of reclaimed land would then be used to store the 6,500m3 of material that would need to be dredged from the proposed marina area to create the minimum operating depths of -2.5m. Implementing this option would therefore alleviate the need to dispose of the dredged material at sea.

Due to the land reclamation, this size of the marina area would be slightly smaller at c.14,000m^2.

Plate 3.13 below illustrates an indicative layout of conceptual marina Option 3b.

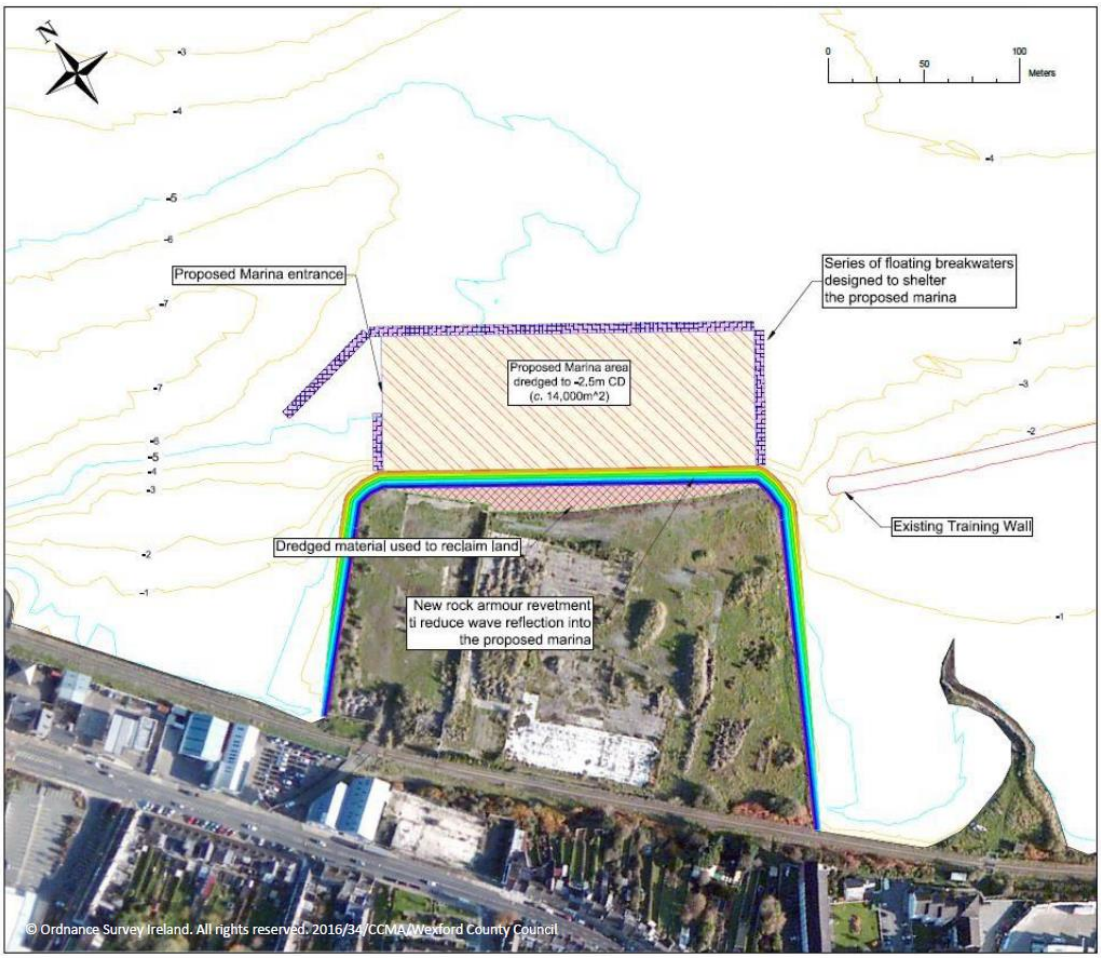

Plate 3.13 Indicative layout of conceptual marina Option 3b

Conceptual Marina Option 4

The fourth option is based on developing the south eastern side of Trinity Wharf to create an attached marina behind the existing training wall. This particular option would create a potential marina area of approximately 25,000m^3. However, despite the large marina area created by this option, the actual usable size would be seriously compromised due to the existing small harbour in this area known as Goodtide Harbour. An indicative layout of this conceptual Option is illustrated in Plate 3.14.

To create a suitable wave climate, it would be necessary to construct a series of floating breakwaters to the south east of the proposed site. To provide an entrance to the proposed marina area c. 40m of the existing training wall would have to be demolished. Furthermore, to prevent wind generated waves entering the marina area from the north westerly sectors it would be necessary to extend the existing seawall to tie in with the north eastern corner of Trinity Wharf.

To create the appropriate minimum operating depth of -2.5m CD it would be necessary to dredge and dispose of approximately 87,000m^3 of marine sediment.

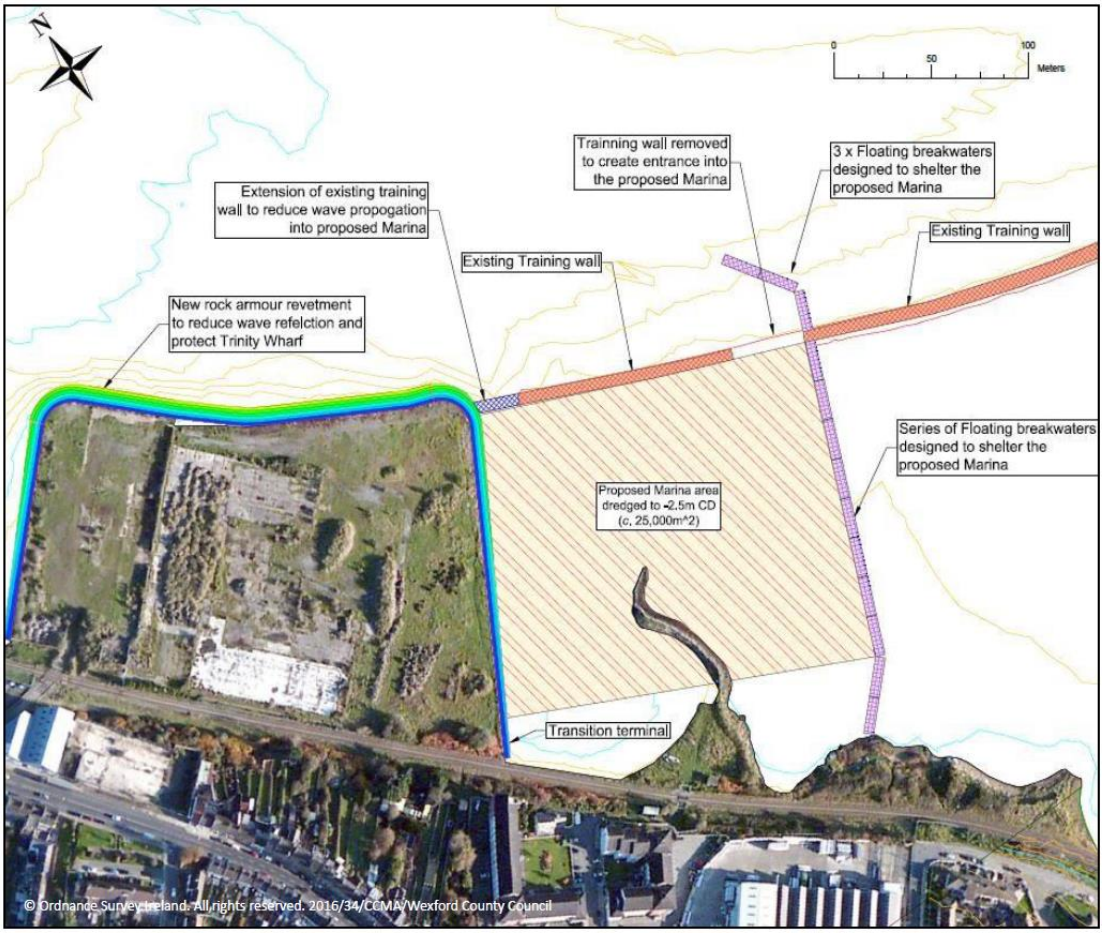

Plate 3.14 Indicative layout of conceptual marina Option 4

Summary of Options

Based on knowledge of existing site conditions it was determined that due to the demanding maintenance dredging programs that would be required to maintain the minimum operating depths in the proposed marina areas detailed in Options 1 and 4, neither of these options were feasible from an environmental or cost perspective. The initial capital dredging required to implement either of these options also has the potential to create significant environmental impacts.

Following on, a computation assessment was then carried out on Options 2, 3, 3a and 3b, as Options 1 and 4 were ruled out from this further assessment due to the reasons stated above.

The potential impact of the four shortlisted marina options on the existing wave climate, tidal regime and sediment transport regime was assessed using a combination of high-level analysis and a series of computational models. The results of the assessment are summarised in Table 3.1 below.

Table 3.1 Summary of Assessment of Options

Conceptual Layout	Summary of Works	Proposed Marina Area m^2	Impacts of marine environment		
			Impact on wave climate	Impact on tidal regime	Impact on sediment transport
1	Installing a series of floating breakwater	16,000	N/A	N/A	N/A
	Dredging & disposing of c.40,000m^3 of material				
2	Installing a series of floating breakwater	6,600	Positive impact	No significant impact	No Dredging required – No impact
	No dredging required (based on marina layout plan)				
3	Installing a rubble mound breakwater	18,000	Positive impact	Significant negative impact	Major capital works – high impact
	Dredging & disposing of c.6,500m^3 of material				
3a	Installing a rubble mound breakwater	18,000	Positive impact	No significant impact	Minor dredging required – minor impact
	Dredging & disposing of c.6,500m^3 of material				
3b	Installing a series of floating breakwaters	14,000	Positive impact	No significant impact	Minor dredging required – minor impact
	Reclaiming c. 10m of land on the north east boundary				
	Using the reclaimed area to store the 6,500m^3 of dredged material				
4	Installing a series of floating breakwaters	25,000	N/A	N/A	N/A
	Extending the existing training wall to meet the Trinity Wharf				
	Modifying the existing training wall to create a marina entrance				
	Dredging & disposing of c. 87,000m^3 of material				

As can be seen from this table, Option 3 was considered unfeasible as the fixed rubble mound breakwater was found to have a significant adverse impact on the existing tidal regime. Furthermore, it is expected that the notable capital works required to construct the fixed rubble mound breakwater, including dredging works, would result in unacceptable environmental effects within the adjacent Natura 2000 sites.

Option 3a and 3b were found to be generally similar in all respects in that neither Option resulted in any significant negative impacts to the existing coastal processes at Trinity Wharf and that both are technically viable options. However, it should be noted that both Options require a small amount of dredging to achieve the desired navigational depth and could therefore have potential impacts on the adjacent Natura 2000 sites in the absence of mitigation measures.

The Trinity Wharf Marina Feasibility Study concluded that Option 2 is the preferred marina option as it is considered to be the most environmentally sustainable and technically feasible option. The reasons for this include:

- Option 2 requires less than 50% of the area of the other options;
- Option 2 has virtually no impact on the existing tidal regime as the sheltered marina area is created using a series of floating breakwaters that only interact with the very top layer of the water column;
- Due to the location of the marina, no capital dredging works are required to achieve the desired minimum operating depth of -2.5mCD;
- The lack of capital dredging works ensures that the proposed marina will not negatively impact the nearby environmentally sensitive areas; and
- As there is very little siltation within the proposed marina area, Option 2 is unlikely to require a continuous maintenance dredging campaign.

3.7.8 Foundations for Marina

Steel Piles

One of the methods assessed for securing the proposed marina in situ is through the installation of a series of suitable steel circular piles. These piles would be driven into the seabed or grouted into sockets which had previously been installed by a pile driving/drilling barge during the construction of the proposed boardwalk between Trinity Wharf and Paul Quay.

Piles are considered advantageous for this project due to their high structural strength and robust loading capabilities. Piles are generally suitable for most seabed conditions but may have to be grouted into sockets if the material comprising the seabed is particularly rocky or contains a high fraction of boulders. If the seabed is particularly soft, over a significant depth, then piles may become impractically large and an anchored system may be preferred.

Using piles would secure the proposed marina in a fixed position which is advantageous when considering the tolerances on dredge limits and less onerous design of access bridge fixings. Future maintenance dredge requirements are also simpler to undertake when compared with anchored restraint systems where seabed anchorages need to be avoided. Although piled structures have a slightly higher initial capital cost relative to alternative restraints (mainly due to high mobilisation costs of a barge for pile driving), the durability and robustness of the piles combined with the less frequent inspection and maintenance requirements, often makes piles a more affordable solution in the long-term. Piles may need inspection every c. 5 – 10 years but may have anodes affixed as a precaution from the outset. Piles are considered to

be an attractive option, particularly in this case where a barge will be in attendance, in any case, to install boardwalk piles.

Chained Restraint System

An alternative option would be to restrain the proposed marina using a series of anchor chains connected to blocks buried in the seabed or helical screw anchors drilled into the seabed. The initial capital cost of this option would likely be less than installing piles, however the increased movement of the marina together with the associated wear and tear on the chains and pontoon joints would increase the long-term cost of this option.

A chained restraint system would typically require inspection and possible maintenance every c. 2 – 4 years for the duration of the marina design life and may need to be replaced after perhaps 10-15 years. Chains also allow a greater degree of movement of the overall system and can be difficult to tension correctly so that each individual chain contributes the correct restraint to the overall pontoon system. Chains generally need to be crossed over one another to provide the correct alignment of restraint force in various directions and this can lead to clashes at the extreme range of movements. Chains should generally be criss-crossed laterally underneath pontoons to avoid interference with the hulls of vessels berthing.

While previous geotechnical investigation results have fed into the design of the marina, the preferred system of foundations for the marina has not yet been decided as the results of the further, scheduled detailed geotechnical investigations of the seafloor will determine the exact details of the restraint system required. This will be developed during detailed design upon receipt of the further ground investigations. Therefore, both of these options are considered in this the EIAR, to ensure the worst case scenario has been assessed.

3.7.9 Boardwalk link from Paul Quay

A requirement of the development is to create a pedestrian/cycleway access from the existing Paul Quay promenade to the Trinity Wharf development.

The initial consideration for the pedestrian/cycleway access was to construct 6m wide footpath alongside the railway to the north of the Trinity Wharf site by constructing out into the sea with a rock revetment. This revetment would essentially be a widening of the existing revetment that exists alongside the railway line.

Plate 3.15 illustrates the envisaged arrangement.

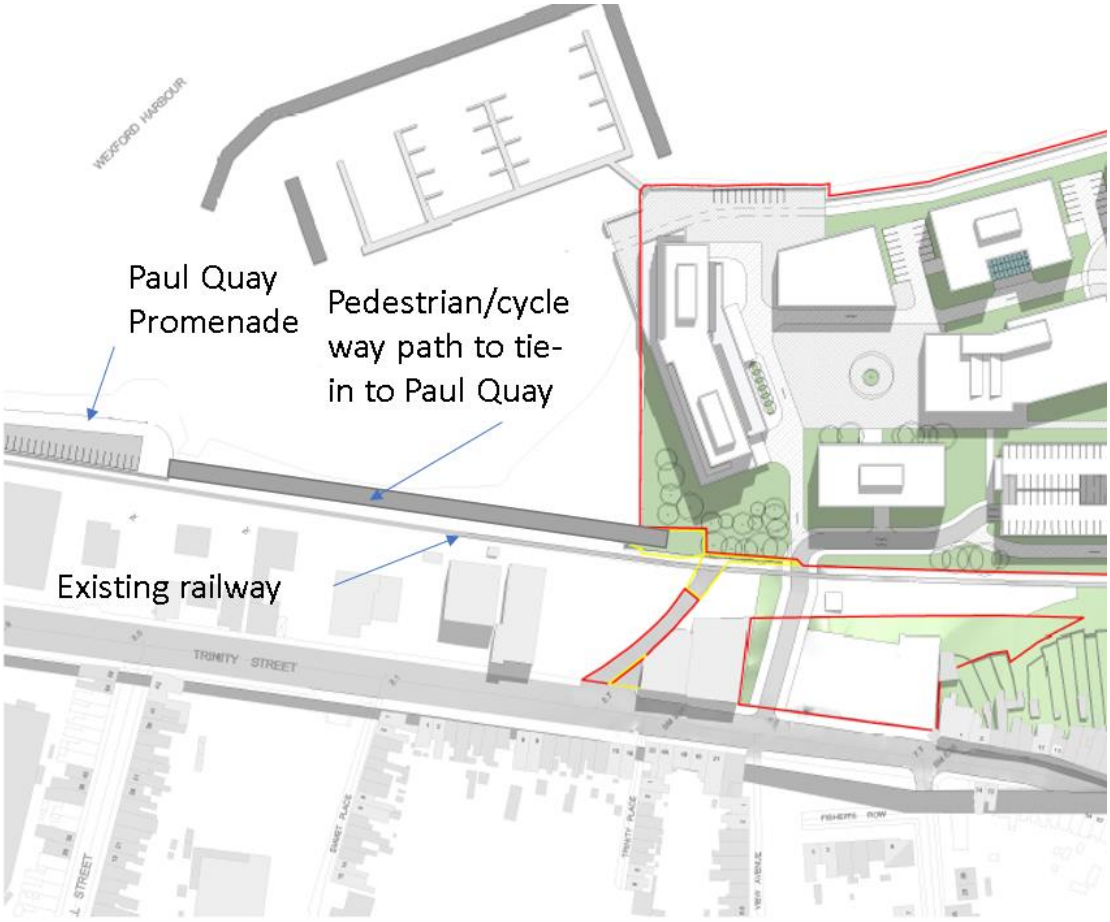

Plate 3.15 **Pedestrian access alongside railway (Note: the site layout in this plate is taken from the conceptual design stage and contains elements including the site boundaries, have been updated as part of the final design)**

This option would require significant construction works to be carried out in order to build out and widen the revetment with significant interaction difficulties with the railway being required for excavation and backfilling works.

The alternative option for the pedestrian link was to construct a bridge from the end of Paul Quay to the north-east corner of the development site. This option would consist of a structural steel bridge constructed on discrete supports on the sea bed.

This option was chosen as the preferred as it would be less intrusive to the estuary, reducing the impact on the area to be impacted within the Slaney River Valley SAC and would not impact the foreshore as significantly as the construction of a rock armour revetment. There would be no concerns regarding interactions with the railway and would provide a much better amenity and pedestrian/cyclist entrance to the site.

3.8 Design Development

3.8.1 Flooding and Surface Water Drainage

It was established at an early stage that the site is located in an area at risk of coastal and pluvial flooding and as such extreme flood events combined with high tides would have to be a consideration in the design of the drainage strategy for the development site. Records of previous occupancies existing on the site have not suggested that there was any public drainage system and as such no existing connection to the public foul/combined drainage appears to exist.

Due to the flooding requirements described in section 4.3.4, the level of the development is required to be raised by approximately 1.5m above its current level. A surface water drainage system which connected into the public foul/combined drainage system was considered for the proposed development, however this would require the construction of a network of drainage pipes, attenuation systems and a pumping station which would be expensive to construct, operate and maintain while also requiring significant excavation of potentially contaminated ground to accommodate attenuation systems below ground. Additionally, this option would add significant quantities of water to the existing network.

The alternative to this option comprises predominantly SuDS features which will attenuate and cleanse the surface water runoff from the site prior to discharge to the sea through a number of outfalls. This option means that all surface water remains on the site and no major infrastructure would be required to be constructed and maintained.

While the option of connecting to the public sewer would remove the need for surface water to outfall to the sea, the provision of SuDS features will attenuate and treat any surface water before discharging through a number of outlets around the site exterior. The SuDS option has been selected as the preferred option.

3.8.2 Seawall

Four alternative designs/combinations of designs were considered for the construction of the new boundary sea wall for the Trinity Wharf development and are as follows:

1. Upgrade of existing sea wall;
2. Steel sheet piled wall;
3. Rock armour revetment; and
4. A combination of steel sheet piled wall and structural rock armour revetment.

3.8.2.1 Upgrade of Existing Sea Wall (Option 1)

The existing sea wall around the Trinity Wharf currently comprises a combination of shallow rock armour along the southern edge, reinforced concrete wall along the eastern edge and stone masonry wall along part of the eastern and all of the northern edge of the site. As seen in Plates 3.16 and 3.17 below, the existing sections of structural wall show signs of deterioration and have been assessed to be inadequate to be maintained or rehabilitated for the proposed development.

Plate 3.16 Existing sea wall facing south along eastern edge of the site

Plate 3.17 Existing sea wall facing east at the southeast corner of the site

In addition, due to the flooding requirements described in section 4.3.4, the level of the development is required to be raised by approximately 1.5m above its current level. Utilising and modifying the existing sea wall for the purposes of this development is therefore unfeasible and as such, a new sea wall must be constructed around the perimeter of the site.

3.8.2.2 Steel Sheet Piled Wall (Option 2)

The use of a steel sheet piled wall consists of installing steel sheet piles along the perimeter of the site to a level of approximately 3.5mOD to retain the raised levels of the development site. The sheet piles would be embedded into the stiff gravelly clay layer at approximately -10.5mOD and would have ground anchors to anchor the top section of the sheet pile wall to control deflection. The ground anchors would be tied back to an anchorage system located below finished ground level. A reinforced concrete capping beam would be constructed to the top of the sheet pile wall to support a handrail.

This option would not require any excavation of the potentially contaminated material currently on the site. Plate 3.18 below shows a typical cross section of the sheet piled wall design.

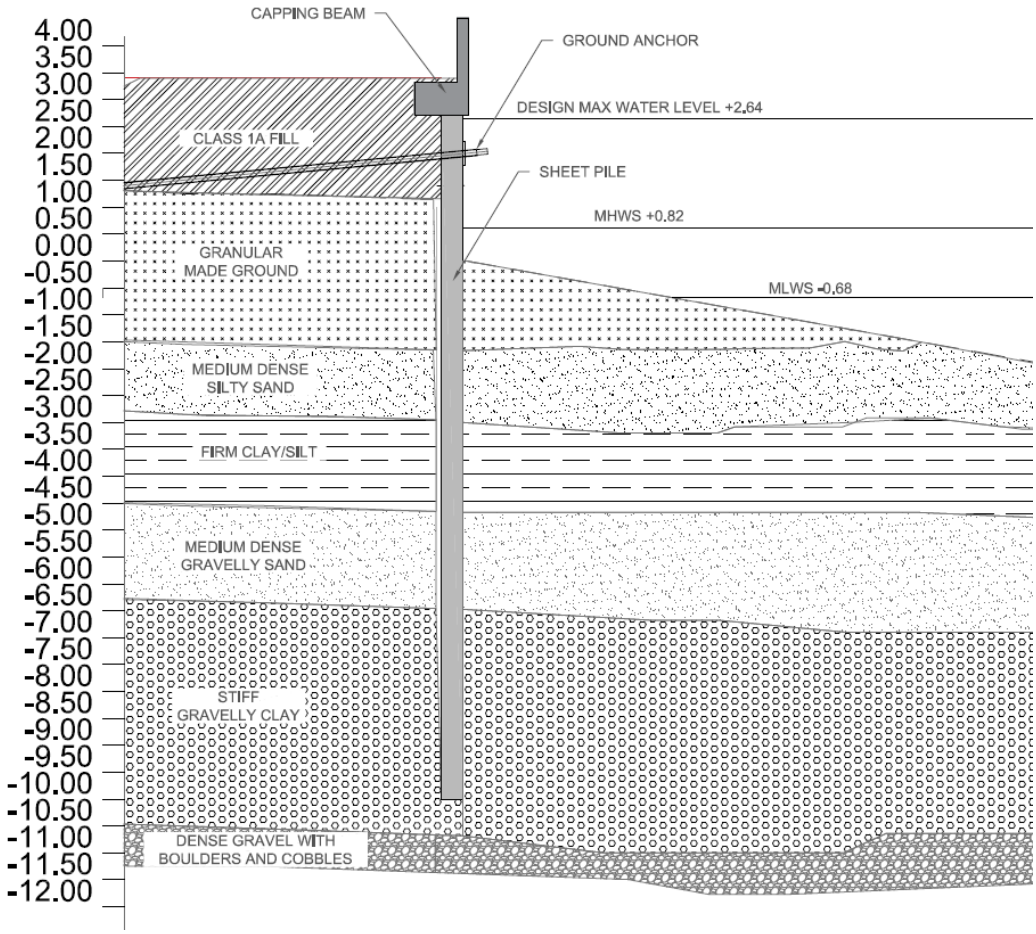

Plate 3.18 Sheet piled wall design

3.8.2.3 Structural Rock Armour Revetment (Option 3)

This option consisted of the construction of structural rock armour to form a 1 in 1.5 sloped revetment which protrudes out into the sea. The rock armour revetment would comprise a woven geotextile separator over which a double stone underlayer and under a double layer of armour stone is placed.

Excavation of the sea bed would be required for this option in order to construct the toe of the revetment and ensure it is deep enough to reduce any risk of scour of the revetment structure. The construction of the revetment toe would therefore require the excavation of large quantities of potentially contaminated material which would require appropriate disposal.

This option would have greater impacts on ecology within the SAC due to the excavation of large quantities of potentially contaminated land. In addition, the construction of the revetment would encroach significantly into Wexford Harbour, requiring the excavation of lands which are designated as Qualifying Interests of both the Slaney River Valley SAC and Wexford Harbour and Slobs SPA.

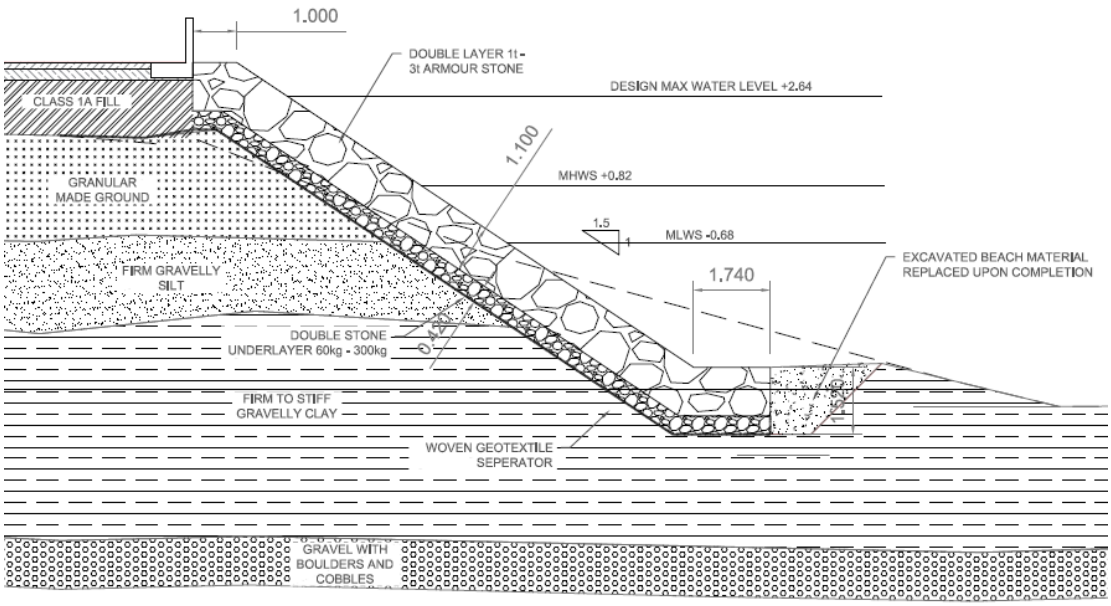

Plate 3.19 Structural Rock Armour Revetment design

3.8.2.4 Combination of Sheet Piled Wall and Structural Rock Armour Revetment (Option 4)

This option consisted of a combination of structural rock armour revetment and sheet piled wall in the arrangement indicated in Plate 3.19.

For this option, as per Plate 3.19, a rock armour revetment design was proposed for areas of the site where the level difference between the foreshore and the finished site was greatest, effectively around the northern corner of the site and along the majority of the eastern edge. In addition to this, a sheet piled wall solution was proposed to be utilised in the shallower areas, namely along the north-westerly edge of the site, the southeast corner and southern edge. While the area to be excavated for the area of rock armour proposed for this option was less than the area required for Option 3, it would still require some landtake and works within the foreshore.

The main advantages of doing this were as follows:

- Reduced excavation of potentially contaminated material from the foreshore in areas where sheet piling is proposed.
- Reduced maintenance of steel sheet piled wall.
- Reduced noise levels of driving sheet piled wall sections during construction stage.

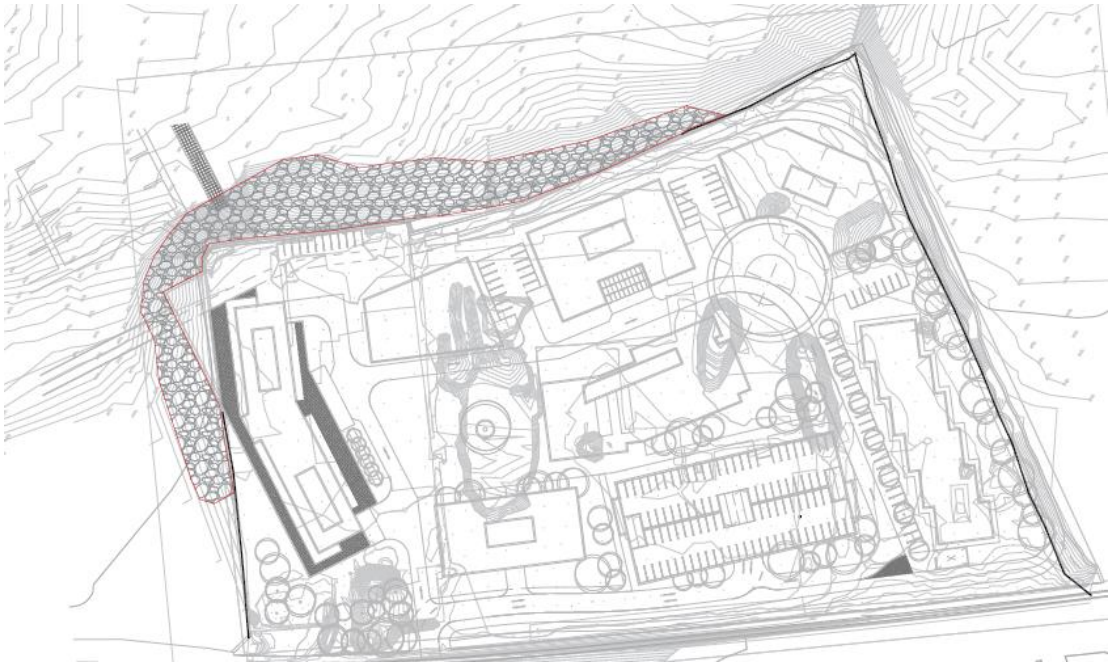

Plate 3.20 Combination of sheet piled wall and structural rock armour revetment

An assessment of the developed options was assessed using the matrix shown in Table 3.2 following.

The result of the assessment carried out demonstrated that the preferred option is the sheet piling option (Option 2). The main factors in coming to this conclusion were largely environmental and cost. The quantities of potentially contaminated material for which excavation would be required in constructing the toe of a rock armour revetment and the associated impact on the designated sites were significantly greater with Option 3 and 4.

While the sheet piled option was chosen from the alternatives considered subsequent to Public Consultation on the Preferred Option, rock armour revetment has since been added to the north-westerly corner and southern edge of the development as described in Chapter 4 Description of the Proposed. While this rock armour will encroach on a small area within the SAC and SPA, the rock armour is not structural and will therefore not require any excavation of material, as it will be placed on the surface of the existing sea bed.

Table 3.2 Summary of Assessment of Options

	Sheet Piled Wall	Revetment	Combination
Parameters	**Option 2**	**Option 3**	**Option 4**
Imported acceptable material (rock armour & underlayer)	0	9000m^3	4700m^3
Sheet Piles	8200m^2	0m^3	5256m^2
Concrete	5700m^3	0	3650m^3
Volume of potentially Contaminated material to be excavated	0m^3	10,000m^3	5000m^3
Human Environment			
Effect on Human Health	Avoids/Minimises excavation of contaminated material	Excavation of contaminated material creating risk to human health	Some excavation of contaminated material creating risk to human health
Effect on Properties - Foreshore	No impact on foreshore	Greater loss of foreshore due to slope of revetment.	Some impact on foreshore
Noise & vibration impacts on properties and species nearby	Noise from driving of sheetpiles	Noise from excavation of potentially contaminated material and transportation.	Noise from driving of sheet piles and from excavation of potentially contaminated material and transportation, however this will be for shorter periods of time
Air Quality impacts on properties and species nearby	Emissions from driving of sheet piles	Emissions from excavation of material and more so transportation of potentially contaminated material to Germany.	Some emissions from excavation of material and transportation however less than construction of a full revetment.
Potentially Contaminated Land / Waste	Leaves potentially contaminated land in place and sheet piles acts as barrier to migration of seepage into the waterbody.	Excavation of significant volumes of contaminate land. Large volume will likely require disposal to a licensed facility (Germany).	Excavation of some potentially contaminated land and either treatment and burial on site or disposal.
Aquaculture	Avoids loss of shellfishery and minimises disturbance.	Greater potential for disturbance and impacts on Shellfishery	Reduced potential for disturbance and impacts on Shellfish.

	Sheet Piled Wall	Revetment	Combination
Natural Environment	**Option 2**	**Option 3**	**Option 4**
Impact on designated site	Minimal if any loss of habitat as wall can be built inside or on edge of existing perimeter.	Greater disturbance & construction works in the SAC and SPA. Greater footprint in SAC and SPA - loss of habitat.	Some disturbance and land required within the SAC. Excavation and loss of habitat required within the SAC.
Archaeology	Only footprint is on made land.	Greater potential for impacts or finds due to greater footprint.	Some potential for impacts or finds.
Hydrodynamics	Acceptable effects	Acceptable effects	Acceptable effects
Landscape and Visual	Least aesthetically pleasing.	Most aesthetically pleasing	Somewhat aesthetically pleasing.
Economy			
Estimated cost for construction	€3.177M	€2.356M	€3.229M
Safety			
Construction Safety	No safety issues due to potentially contaminated land handling.	Safety issues associated with dealing with potentially contaminated land.	Safety issues associated with dealing with potentially contaminated land.
Maintainability	Maintenance of sheet piles required.	Minimal Maintenance	Some maintenance of sheet piles required.
Ranking/Conclusions			
Impact on Humans	Most Preferable	Least Preferable	Second Most Preferable
Effect on Natural Environment	Most Preferable	Least Preferable	Second Most Preferable
Economy	Second Most Preferable	Most Preferable	Least Preferable
Constructability	Most Preferable	Most Preferable	Most Preferable
Safety	Most Preferable	Least Preferable	Second Most Preferable
Overall Mark (Lowest Preferable)	Most Preferable	Least Preferable	Second Most Preferable