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Passage West Pedestrian and Cycle route

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Site Specific Flood Risk Appraisal

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1. Introduction

Ryan Hanley was appointed by Cork County Council for the provision of engineering services for walking and cycling connectivity between Glenbrook and Rochestown, through the town of Passage West.

As part of the planning process for the project, Ryan Hanley has been commissioned to undertake a Site-Specific Flood Risk Assessment (FRA) for the proposed development.

Under the Planning System and Flood Risk Management Guidelines for Planning Authorities (DoEHLG & OPW, 2009), the proposed development must undergo a FRA to ensure sustainable development and effective management of flood risk.

The scope of this site-specific FRA includes:

- A description of the existing site conditions, the proposed development and the baseline data used in this report.
- A review of "The Planning System and Flood Risk Management Guidelines for Planning Authorities and Technical Appendices (November 2009)" (OPW / DoEHLG)
- Preparation of a Site- Specific Flood Risk Assessment Report including:
  - Identification of potential sources of flood risk
  - Hydrological assessment
  - Flood Risk Assessment
  - Completion of a Justification Test/ Commensurate Assessment (if applicable) for the site
  - Identification of the residual flood risk and recommending specific mitigation measures and inform decisions relation to planning.

Topographical and water level data supplied in this report are relative to the Ordnance Survey Datum Malin Head unless otherwise stated.

2. The Planning System and Flood Risk Management Guidelines OPW

This Flood Risk Assessment has been undertaken in accordance with "The Planning System and Flood Risk Management: Guidelines for Planning Authorities & Technical Appendices" produced by the Office of Public Works (OPW) in November 2009.

2.1 The Planning Systems and Flood Risk Management Document

The Planning Guidelines give guidance on flood risk, its identification, assessment, and management in areas of potential development. The Guidelines recommend a "precautionary approach" (See Sections 1.11, 2.30, 3.1 and 5.16) when considering flood risk management in the planning system. The core principle of the guidelines is to adopt a risk-based approach to managing flood risk and to avoid development in areas that are at flood risk. This sequential approach is based on the identification of flood zones for river, lake, and coastal flooding, as shown Figure 2-1and Table 2-1: Indicative Flood Zones (OPW & DoEHLG, 2009).

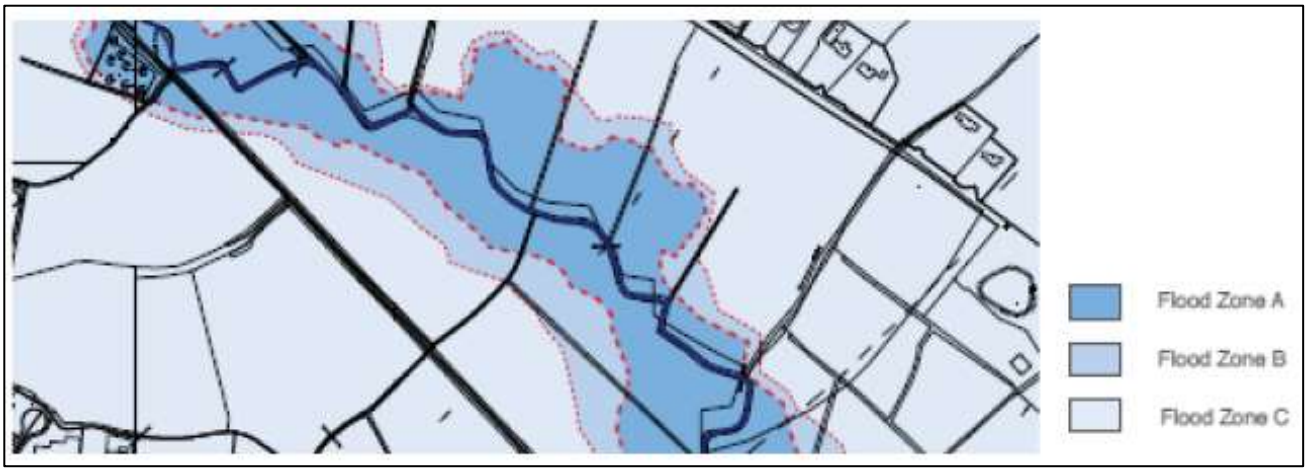

Figure 2-1: Indicative Flood Zones (OPW & DoEHLG, 2009

Flood Zone	Definition	Annual Exceedance Probability
A	*Probability of flooding from rivers, lakes and the sea is highest*	*Greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding*
B	*Probability of flooding from rivers and the sea is moderate*	*Between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding*
C	*Probability of flooding from rivers and the sea is low. Flood Zone C covers all areas of the plan which are not in zones A or B*	*Less than 0.1% or 1 in 1000 for both river and coastal flooding*

Table 2-1: Indicative Flood Zones (OPW & DoEHLG, 2009)

2.2 Vulnerability and Land Use

The guidelines recognise that the vulnerability of potential development to flooding depends on the specific type of land use. Thus, defining the vulnerability of land use types to flooding can help when choosing appropriate development types in areas that are prone to flooding. Vulnerability, land use and development types for this purpose are presented in Table 2-2.

Table 2-2: Extract from Guidelines for Planning Authorities - Classification of vulnerability of different types of development

Vulnerability Class	Land uses and types of development which include:
Highly Vulnerable development (including essential infrastructure)	Garda, ambulance and fire stations and command centres required to be operational during flooding;
	Hospitals;
	Emergency access and egress points;
	Schools;
	Dwelling houses, student halls of residence and hostels;
	Residential institutions such as residential care homes, children's homes and social service homes;
	Caravans and mobile home parks;
	Dwelling houses designed, constructed or adapted for the Elderly or, other people with impaired mobility; and
	Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution (SEVECO sites, IPPC sites etc) in the event of flooding
Less vulnerable development	Buildings used for; retail, leisure, warehousing, commercial, industrial and non-residential institutions
	Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuations plans;
	Land and buildings used for agriculture and forestry
	Waste treatment (except landfill and hazardous waste);
	Mineral working and processing; and
	Local transport infrastructure
Water-compatible development	Flood control infrastructure
	Docks, marinas and wharves;
	Navigation facilities;
	Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location;
	Water-based recreation and tourism (excluding sleeping accommodation);
	Lifeguard and coastguard stations;
	Amenity space, outdoor sports and recreation and essential facilities such as changing rooms; and
	Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan

The probability and vulnerability of flooding informs the requirement for the application of a Justification Test. The decision matrix, illustrated in Figure 2-2 below, shows a simple way of combining probability and vulnerability of flooding in order to classify the potential risk to the proposed development. Where the risk is considered high, then a Justification Test is required and applied.

Vulnerability Class	Flood Zone A	Flood Zone B	Flood Zone C
Highly Vulnerable development (including essential infrastructure)	Justification test	Justification test	Appropriate
Less vulnerable development	Justification test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

Figure 2-2: Extract from Guidelines for Planning Authorities - Matrix of vulnerability versus flood zones required to meet the Justification Test

The Justification Test represents a series of conditions that must be met when flood risk is considered significant. Even if the Justification Test is not applied, an appropriately detailed Flood Risk Assessment should be completed in order to fully consider flood risk to the potential development. These conditions are set out in Figure 2-3 below (section 5.15 of the Guidelines).

Box 5.1 Justification Test for development management (to be submitted by the applicant)
When considering proposals for development, which may be vulnerable to flooding, and that would generally be inappropriate as set out in Table 3.2, the following criteria must be satisfied:
1. The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines
2. The proposal has been subject to an appropriate flood risk assessment that demonstrates:
(i) The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk;
(ii) The development proposal includes measures to minimise flood risk to people, property, economy and the environment as far as reasonably possible;
(iii) The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures of the design, implementation and funding of any future flood risk management measures and provisions for emergency services access; and
(iv) The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.
The acceptability of otherwise of levels of residual risk should be made with consideration of the type and foreseen use of the development and the local development context.
Note: See section 5.27 in relation to major development on zoned lands where sequential approach has not been applied in the operative development plan.
Refer to section 5.28 in relation to minor and infill developments

Figure 2-3: Extract from Guidelines for Planning Authorities – Box 5.1 Justification for development management

2.3 Stages of Flood Risk Assessment

"The Planning System and Flood Risk Management: Guidelines for Planning Authorities" document outlines that a staged approach to Flood Risk Assessment should be adopted and the stages of appraisal and assessment are as follows:

> *"Stage 1 Flood Risk Identification – to identify whether there may be any flooding or surface water management issues related to either the area of regional planning guidelines, development plans and LAP's or a proposed development site that may warrant further investigation at the appropriate lower level plan or planning application levels;*
>
> *Stage 2 Initial Flood Risk Assessment – to confirm sources of flooding that may affect a plan area or proposed development site, to appraise the adequacy of existing information and to scope the extent of the risk of flooding which may involve preparing indicative flood zone maps. Where hydraulic models exist the potential impact of a development on flooding elsewhere and of the scope of possible mitigation measures can be assessed. In addition, the requirements of the detailed assessment should be scoped; and*
>
> *Stage 3 Detailed Flood Risk Assessment – to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to a proposed or existing development or land to be zoned, of its potential impact on flood risk elsewhere and of the effectiveness of any proposed mitigation measures."*

The Guidelines recognise that *'all stages may not be needed to complete a Flood Risk Assessment.'* The required level of detail *'will depend on the level of risk and the potential conflict with proposed development and the scale of mitigation measures being proposed.'*

This flood risk assessment report is considered appropriate and sufficient to allow an informed decision with respect to the proposed development on the grounds of flood risk.

3. Stage 1 and Stage 2 Flood Risk Identification and Appraisal

This section of the report describes the existing site, proposed development details and background information on flood risk to the West Passage site.

3.1 Site Description and Proposed Development

Passage West is a Lower Harbour commuter settlement with a well-defined urban structure reflective of its importance as a shipbuilding and railway terminus, but the function of the retail core has declined in recent decades. Passage West functions as an important residential area with excellent recreational facilities centred on its harbour location. Continued population growth may be constrained by the town's topography, the lack of transportation infrastructure and the proximity of the docks near its centre.

Figure 3-1: Satellite image and GIS map of Study area

The purpose of the proposed pedestrian and cycle route is to provide a prioritised, safe, and 2km long and 4.0-4.5m wide route segregated from roads for vulnerable users between the Passage West car park and Passage West playground. The proposed works will comprise of the following:

- Upgrade an existing 2km long and 2-2.5m wide path to a 4-4.5m wide Pedestrian and Cycle Path with new public lighting;
- Construction of a prioritised, segregated from traffic, and safe cycle and walking route;
- Construction/Extension of pedestrian and cycleway bridges;
- Signage (map boards, tourist information, road signage);
- Construction of cycle parking facilities, including cycle stands and benches;
- Site clearance and accommodation works;
- Minor earthworks and excavations;
- Construction/rehabilitation of surface drainage;

- New utilities or alternative routing of existing utilities;
- Landscape Architecture, where required; and,
- Ancillary works.

The proposed route has a low gradient with varied surface levels from 4.16 m OD to 2.93 m OD. The highest levels are located to the northwest of the Passage West car park, and the lowest point is located next to the playground. Figure 3-2 shows the surface levels along the proposed route.

Figure 3-2: Route surface levels

A typical cross section of proposed pedestrian and cycle lane is shown in Figure 3-3.

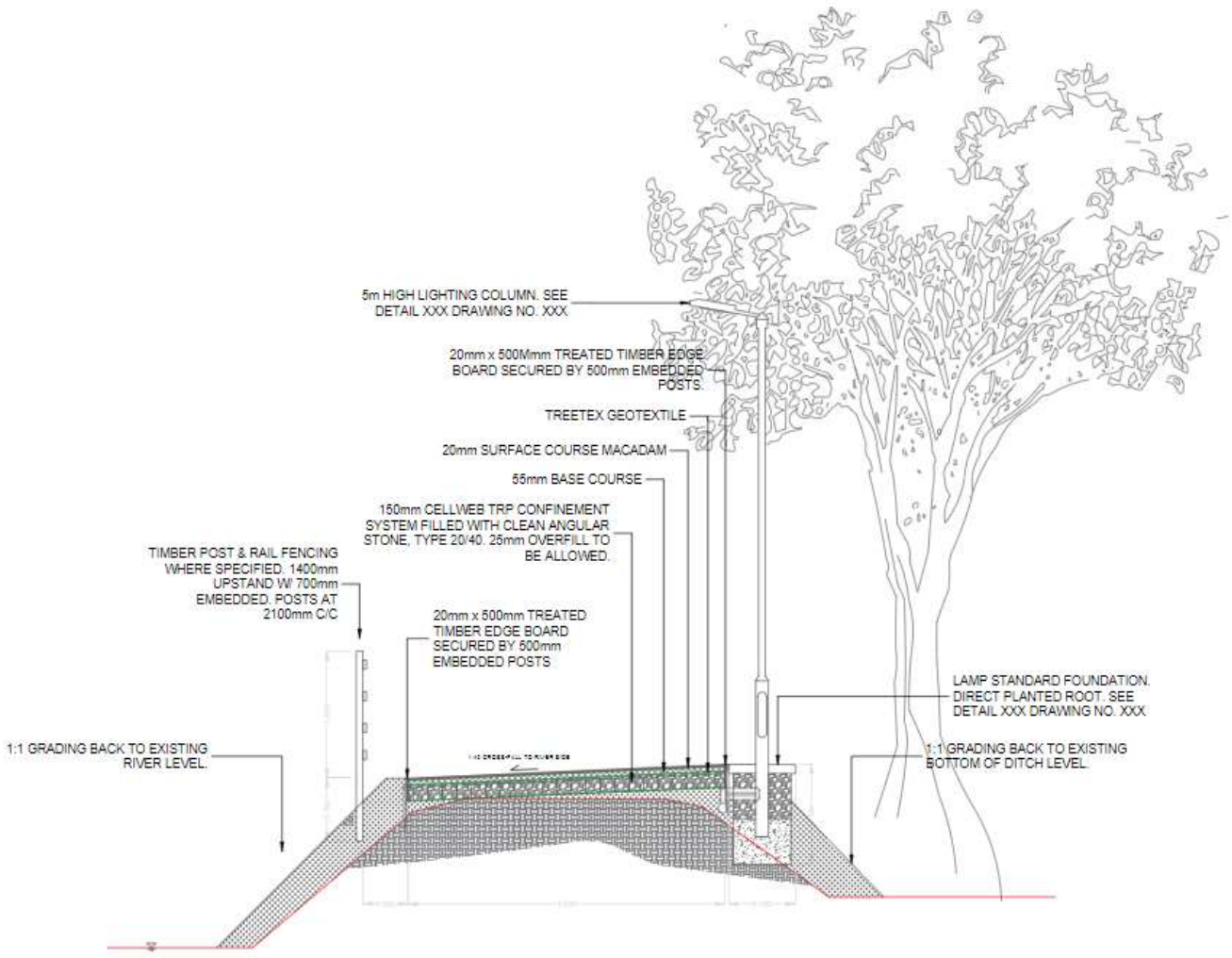

Figure 3-3: Typical Route Cross Section

3.2 Site Hydrology

The development site is located Lower Lee catchment area. The estimated Standard Annual Average Rainfall (SAAR) of 1052 mm/year. (FSU, OPW). The proposed site is situated on Devonian Old Red Sandstones (GSI Geo Portal).

3.3 Initial Flood Risk Assessment

Flooding and flood risk management within the Lower Lee catchment has been comprehensively studied by OPW as part National Catchment Flood Risk Management Plans and most recently as part of the Cork City Flood Relief Scheme (ongoing). These studies concluded that tidal flooding was the only significant source of flooding in the catchment.

A review of the GSI Groundwater Flooding Viewer maps confirmed that groundwater flooding was not a likely source of flooding in the project catchment.

Pluvial flooding is a result of rainfall-generated overland flows which arise before runoff can enter any watercourse or sewer. It is usually associated with high intensity rainfall. The OPW Preliminary Flood Risk Assessment (PFRA) mapping was consulted and confirmed that Pluvial flooding unlikely to represent a significant

source of flood risk in the catchment. Hence it is concluded that the significant source of floods in the project area is solely tidal.

3.3.1.1 Historic Flood Risk

A review of accessible historic flood information was undertaken for area including a review of the OPW database (www.floodinfo.ie). There are five reported flood events in lands adjacent to the proposed development. The majority of the past flooding events are associated with River Lee overflows are provided in Table 3-1.

Table 3-1: Historical Flooding events

Event	Flood ID	Start Date
Passage West Oct 2004	5082	26/10/2004
Flooding at Passage West, Co. Cork	11124	11/11/2009
Flooding at Passage West, Co. Cork	12087	03/02/2014
Flooding at Glenbrook, Passage, co Cork	11123	11/11/2009
Flooding at Monkstown	13744	19/10/2020
Monkstown, Co. Cork	12180	25/01/2013

3.3.1.2 CFRAM OPW study- Tidal Flood Extent

The National Catchment Flood Risk Assessment and Management Programme (CFRAM) was set up to deliver on the core components of the National Flood Policy, adopted in 2004, and on the requirements of the EU 'Floods' Directive (2007/60/EC). The National CFRAM Programme has been carried out in parallel with similar programmes across the European Union, each delivering flood mapping and International Flood Risk Management Plans at the River Basin District (RBD) scale. The Programme commenced in Ireland in 2011 and is central to the medium to long-term strategy for the reduction and management of flood risk in Ireland.

Flood mapping is displayed in Figure 3-4: CFRAM tidal extent maps below and highlights that the site is adjacent to the extent of the 1:1000 tidal flood extent.

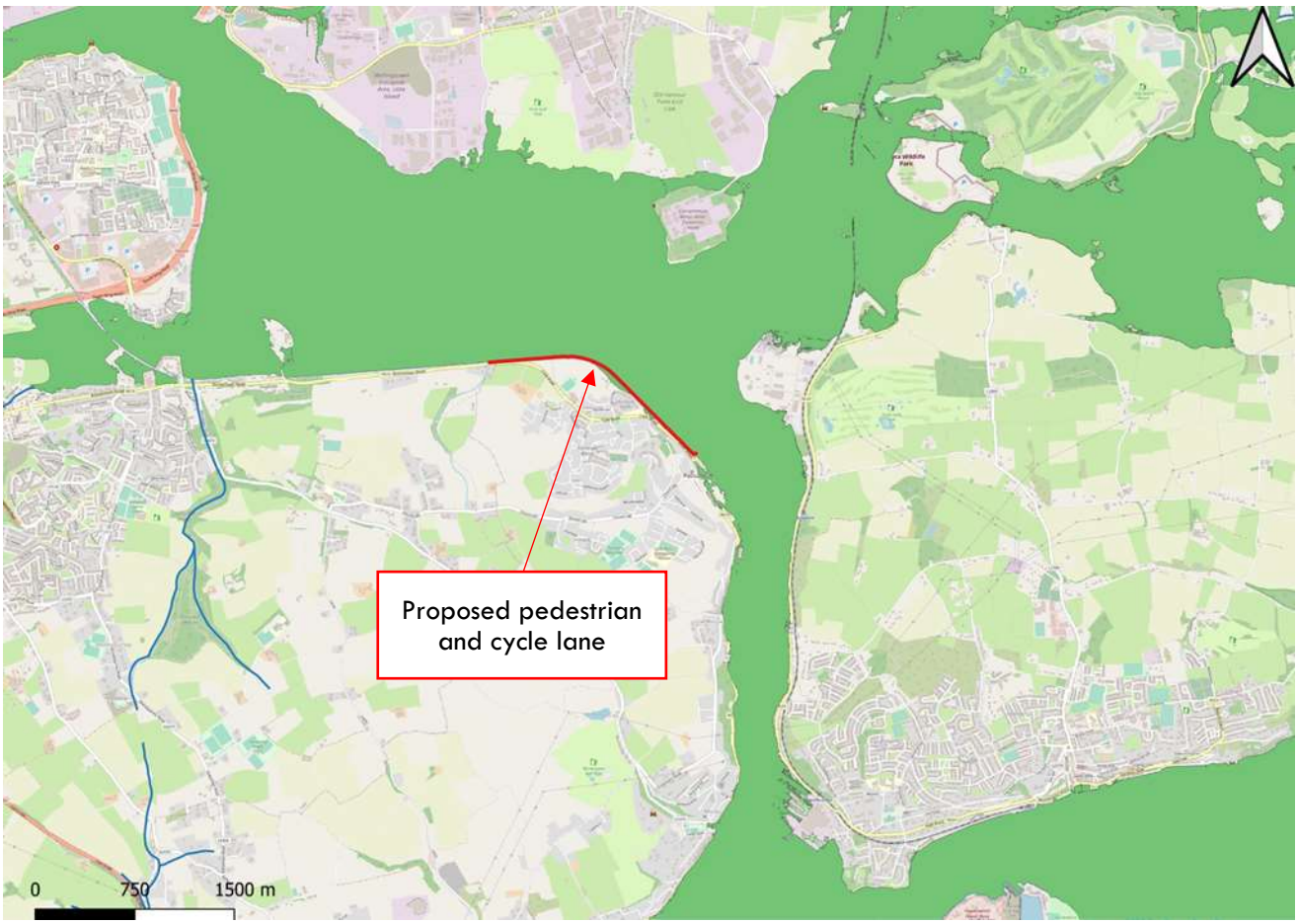

Figure 3-4: CFRAM tidal extent maps

The most up to date Irish Coastal Wave and Water Level Modelling Study (ICWWS-OPW 2018) was used to identify the extreme tidal levels in Cork Harbour. As shown in Table 3-2 any level above 3.31 mOD is in Flood Zone C and levels between 3.12 mOD to 3.31 mOD are located in Flood Zone B.

Tidal water levels associated with the Climate Change allowance are also shown in Table 3-2. Having reviewed the water levels the proposed route is situated in Flood Zone C, except for a short section of route near the existing playground which is situated in Flood Zone B.

Table 3-2: Tidal levels Cork Harbour ICWSS

Tidal levels	Tidal levels
200-years current scenario	3.12
1000-years current scenario	3.31
200-years MRFS	3.62
1000-years MRFS	3.81

3.3.1.3 Fluvial Flood Extent

The site area is not subject to fluvial flooding no major or minor watercourse is in the vicinity of the proposed route. A minor water course is drained approximately 2km west of the subject site as shown in EPA river system in Figure 3-5. Therefore, it can be safely assumed that the fluvial risk is remote.

Figure 3-5: Watercourses in the vicinity of study area

3.3.1.4 Pluvial Flooding

Pluvial flooding is a result of rainfall-generated overland flows which arise before runoff can enter any watercourse or sewer. It is usually associated with high intensity rainfall. The OPW PFRA mapping (Figure 3-6) suggests that the route is adjacent to pluvial flooding areas of 1000 years and 100 years events. Having considered that the new proposed pedestrian and cycling lane will be well elevated above the low lying urban areas since it is related to refurbishment of the abandoned rail line, the pluvial flooding risk can be safely assumed as low.

Figure 3-6: PFRA pluvial risk area

3.3.1.5 Groundwater Flooding

The groundwater flooding for the site is remote given the lack of groundwater flooding records.

3.4 Stage 1 and Stage 2 FRA Conclusions

A Stage 1: Flood Risk Identification and a Stage 2: Flood Risk Assessment have been completed for the proposed development site at the pedestrian and cycle route. Most of the development lies in an area of low flow flood risk (Zone C) and a small part is exposed in Flood Zone B for the current scenario.

The evidence provided by CFRAM, and other studies indicates that the only significant source of flooding in the project area is Tidal. Sufficient reports and gauge data is available to determine design flood levels for the development's site and therefore no additional hydrological or hydraulic assessments are required to allow flood risk at the proposed development sites to be appropriately assessed.

4. Flood Risk Assessment and Management

4.1 Land Use Vulnerability and Development

In accordance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities', the proposed development land use is classed as 'highly vulnerable' (refer to Figure 2-2).

Most of the development lies in an area of low flow flood risk (Zone C) and a small part is exposed in Flood Zone B. Under the MRFS elements identified above are within Flood Zone B. Table 4-1 presents a screening of the project elements for which a Justification Test is required.

Table 4-1: Justification test screening

Ref	Condition	Response for Pedestrian and Cycle Lane
1	The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines.	The new pedestrian and cycle lane is proposed along existing local transport lanes.
2	The proposal has been subject to an appropriate flood risk assessment that demonstrates:	
(i)	The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk;	The proposed development will not increase flood risk or its surrounding area. The flood risk associated with the project are due to changes in climate conditions affecting existing infrastructure. Hence the development, along with the mitigation measures proposed in section 6.1.1. will reduce future flood risks and reduce overall flood risk.
(ii)	The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible;	Some construction measures are provided in chapter 4.1.1.2 to minimise the impacts of pluvial risk
(iii)	The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access;	The nature of the proposed development related to a new pedestrian and cycle lane along an existing local lane will addresses future flood risks

4.1.1.1 Surface Water Management

The following recommendations are proposed to manage the pluvial flood risk for the site:

- Permeable materials to be used for the construction of the new pedestrian and cycle path;
- The permeable materials of the new cross section should allow enhanced groundwater recharge for providing well-watered conditions for the proposed planting.

4.1.1.2 Construction Stage Flood Risk Mitigation

There is a potential for contaminated run-off during the construction stage (e.g. silt, concrete spills, fuels etc.) to discharge into the harbour either directly overland or via the existing surface water drainage system. While the likely potential impact of such construction stage run-off would not be significant, it is not desirable and is readily preventable with good construction practice.

The following mitigation measures are proposed to minimise the flood risk at construction stage:

- The works are to be programmed to be undertaken during non-flood conditions.
- All excavations shall be backfilled as soon as practical, and none shall be left open overnight.
- Temporary surface water management systems (silt-busters or similar approved) shall be in place if required for dewatered flows;
- The Contractor shall ensure that the drainage gullies in the area are maintained clear throughout the works and no contaminated site run-off;
- No refuelling to be undertaken on site (other than pumps). All pumps shall be appropriately bunded and spill kits will be available on site should a fuel spill occur; and,
- The Contractor's compound shall be located in Flood Zone C.

5. Conclusions

The purpose of this FRA report was to identify flood risk associated with a new pedestrian and cycle lane project.

The site is located in Flood Zone C – at low risk of fluvial flooding and is above the potential fluvial flood level of the Cork Harbour as confirmed by OPW studies.

There is a potential for pluvial flooding risk based on the indicative PFRA OPW analysis. Considering the nature of the proposed development which is classified as less vulnerable development related to flood risk proper surface water management measures are recommended during the construction and operational stage.

For the reasons stated above, the proposed route is in line with the core objectives of the Flood Risk Management Planning Guidelines (OPW, 2009) and therefore the proposed site would comply with the national, regional, and local planning policy and would not have a significant negative impact on the environment due to low flooding risk assessed by different sources.