HYDRO ENVIRONMENTAL SERVICES

22 Lower Main St
Dungarvan
Co.Waterford
Ireland

tel: +353 (0)58 44122
fax: +353 (0)58 44244
email: info@hydroenvironmental.ie
web: www.hydroenvironmental.ie

RAISING OF SECTION OF WALKING PATH ALONG ANNE VALLEY WALKWAY, ANNESTOWN, CO. WATERFORD

STAGE II - FLOOD RISK ASSESSMENT

FINAL REPORT

Prepared for:
Waterford City & County Council

Prepared by:
Hydro-Environmental Services

DOCUMENT INFORMATION

DOCUMENT TITLE:	**RAISING OF SECTION OF WALKING PATH ALONG ANNE VALLEY WALKWAY, ANNESTOWN, CO. WATERFORD** **STAGE II - FLOOD RISK ASSESSMENT**
ISSUE DATE:	**22ND MARCH 2021**
PROJECT NUMBER:	**P1386-0**
PROJECT REPORTING HISTORY:	**NONE**
CURRENT REVISION NO:	**P1386-1_FINAL REV F0**
AUTHOR(S):	**MICHAEL GILL** **CONOR MCGETTIGAN**
SIGNED:	 _____ **Michael Gill B.A., B.A.I., M.Sc., MIEI** **Managing Director – Hydro-Environmental Services**

Disclaimer:
This report has been prepared by HES with all reasonable skill, care and diligence within the terms of the contract with the client, incorporating our terms and conditions and taking account of the resources devoted to it by agreement with the client. We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above. The flood risk assessment undertaken as part of this study is site specific and the report findings cannot be applied to other sites outside of the survey area which is defined by the site boundary. This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies upon the report at their own risk.

TABLE OF CONTENTS

FIGURES IN TEXT

TABLES (IN TEXT)

APPENDICES

1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) were requested by Waterford City Council to undertake a Stage II Flood Risk Assessment (FRA) for the raising of a section of walking path along the Anne Valley Walkway between Dunhill Castle and Annestown in Co. Waterford. A site location map is attached as **Figure A** below.

This FRA is carried out in accordance with '*The Planning System and Flood Risk Management Guidelines for Planning Authorities'* (DoEHLG, 2009).

1.2 STATEMENT OF QUALIFICATIONS

Hydro-Environmental Services (HES) are a specialist hydrological, hydrogeological and environmental practice which delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

Our core area of expertise and experience is hydrology and hydrogeology, including flooding assessment and surface water modelling. We routinely work on surface water monitoring and modelling and prepare flood risk assessment reports.

Michael Gill is an Environmental Engineer with 18 years environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological assessments for various developments across Ireland. Michael has significant experience in surface water drainage issues, SUDs design, and flood risk assessment.

Conor McGettigan is a recent graduate, holding an M.Sc in Applied Environmental Science (2020) from University College Dublin, graduating with a First-Class Honours degree. In recent times Conor has assisted with several Flood Risk Assessments for a variety of different developments.

1.3 REPORT LAYOUT

This FRA report has the following format:

- Section 2 describes the site setting and details of the proposed development;
- Section 3 outlines the hydrological and hydrogeological characteristics in the vicinity of the proposed development site;
- Section 4 deals with a site-specific flood risk assessment (FRA) undertaken for the proposed development which was carried out in accordance with the above-mentioned guidelines;
- Section 5 presents a flood impact assessment of the proposed development and assesses same in respect of flood management policy contained in Waterford County Council's County Development Plan; and,
- Section 6 presents the FRA report conclusions.

The assessment methodology involves researching and collating flood-related information from the following data sources:

- Base maps – Ordnance Survey of Ireland;
- Flood Hazard Maps and flooding information for Ireland, www.floodmaps.ie;
- Office of Public Works (OPW);
- Geological Survey of Ireland (GSI) maps on superficial deposits;
- Geological Survey of Ireland (GSI) maps on groundwater and surface water flooding;
- EPA hydrology maps;

- Preliminary Flood Risk Assessment Maps;
- Catchment Flood Risk Assessment and Management (CFRAM) mapping;
- Waterford County Development Plan 2011 – 2017;
- Site Walkover (conducted by HES 02nd March 2021, 17th March 2021, and 19th March 2021); and,
- 1m DSM data of the Anne Valley.

2. BACKGROUND INFORMATION

2.1 INTRODUCTION

This section provides details on the topographical setting of the site along with a description of the proposed development.

2.2 SITE DESCRIPTION AND TOPOGRAPHY

The proposed site subject of this FRA is located between Dunhill Castle and Annestown. The proposal is for raising a section of a walking path along the existing Anne Valley walkway. Annestown is a coastal village situated approximately 24km east of Dungarvan and approximately 9km west of Tramore, Co. Waterford.

It is proposed to raise 940m of walkway located to the south of Dunhill Castle and to the east of the local Dunhill to Annestown road. The total site area is 2.96 hectares. Chainage 0+000m is located at the road access point opposite an old quarry, approximately 300m southwest of Dunhill Castle. From this point the walkway runs southeastwards before veering to the southwest at approximately Chainage 0+130m. The walkway then runs parallel with the meandering Annestown Stream until Chainage 0+700m, where it veers to the west. Chainage 0+940m is located at a second road access point further south along the same road. The walkway then continues south and runs along and parallel to the road for the remained of the Anne Valley Walkway (not subject of this application). The land between this local road and the Annestown Stream is predominantly rushes, scrub, and grassland.

The topography along the walkway route to be raised is currently relatively flat and low-lying. To the north of the site there is a slight rise in ground levels of the walkway near the Dunhill Castle while to the south the walkway is more undulating.

Locally the valley slopes from north to south towards Dunabrattin Bay, at Annestown. Based on 1m DSM data obtained for the Anne Valley, the overall elevation range along the proposed section of walkway to be raised is between 1.3mOD and 2.6mOD (Ordnance Datum Malin Head). The Annestown Stream flows in a north to south direction, discharging into Dunabrattin Bay on Waterford's south coast. A site location map is shown as **Figure A**.

Please note that there is a consistent difference between the purchased 1m DSM data and the elevations provided in the site plans (difference is ~1.65m). While the 1m DSM data shows the current path elevations to be 1.3-2.6 mOD (Malin Head), the site plans provided indicate path elevations ranging from 3.5-4.7m. HES have conducted an independent GPS elevation survey from Annestown Beach northwards as far as Chainage 0+700m (along the path) and these recorded elevations indicate that the 1m DSM data is generally correct to Malin Head datum. Therefore, the 1m DSM elevations were used in this FRA report in preference to existing elevations provided on the site plans as they appear to be to a different datum.

Figure A: Site Location Map

2.3 PROPOSED DEVELOPMENT DETAILS

The proposed development consists of raising 940m of walking path along the existing Anne Valley Walkway.

The existing 2m wide walkway is to be raised by on average 850mm with raised embankments on either side with a 1:2 slope. The imported material will be Class 1A suitable fill material. The raised footpath and associated embankments have a combined footprint of ~4,255m^2 and an approximate fill volume of ~2,800m^3. Once complete the final elevation of the walkway will range from 2.15 – 3.35 mOD.

The proposed development will lift an existing bridge crossing by raising the abutments by 600m and resetting the bridge structure.

An example of the current walkway is provided as Plate A. This picture is taken along the existing Anne Valley walkway, with the Annestown Stream to the east and scrubland to the west of the path.

Plate A: Existing Anne Valley walkway with the Annestown Stream to the east. (Photo looking to the north).

3. ENVIRONMENTAL SETTING AND CATCHMENT CHARACTERISTICS

3.1 INTRODUCTION

This section gives an overview of the hydrological and geological characteristics of the development site and local area.

3.2 HYDROLOGY

3.2.1 Regional and Local Hydrology

On a regional scale, the site is located within Hydrometric Area 17 of the South Eastern River Basin District (SERBD). The site is located in the Colligan-Mahon Water Framework Directive (WFD) Catchment and the Kilmurrin sub-catchment. It is mapped within the Dunhill River sub-basin.

The Annestown Stream flows from Ballylegat, through Dunhill in a southerly direction immediately east of the walkway and enters the sea at the Dunabrattin Bay at Annestown.

A tributary (Ballylenane) of the Annestown Stream flows parallel and immediately to the north of the walkway before joining the Annestown Stream east of Chainage 0+140m. A second unnamed tributary flows from the east, joining the Annestown Stream at the same location. The Annestown Stream then continues to southwards, roughly parallel with the walkway.

To the south of the section of walkway to be raised, a number of drainage channels connect to the Annestown Stream. These channels run perpendicular to the Annestown Stream and drain the higher land and floodplain to the west of the stream. A tributary (Woodstown 17) of the Annestown Stream flows from east of the R675 and joins the Annestown Stream approximately 200m before it enters Dunabrattin Bay.

A local hydrology map is shown as **Figure B**. The site drainage is described in further detail at **Section 4.4.1**.

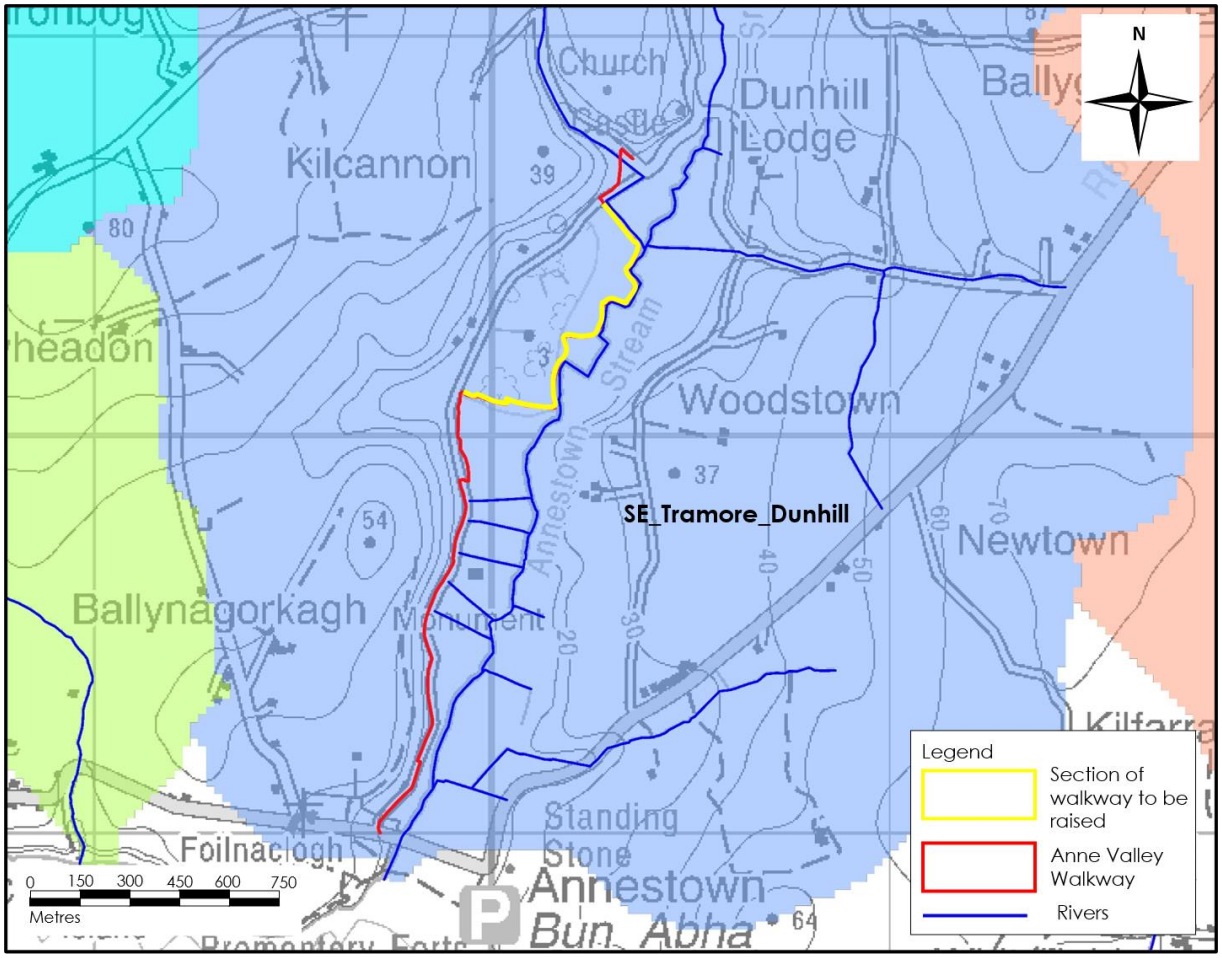


Figure B: Local Hydrology Map

3.2.2 Rainfall and Evaporation

The SAAR (Standard Average Annual Rainfall 1981 - 2010) recorded at Fenor (Islandtarsney) (approximately 3.5km northwest of the site), the closest rainfall station to the site with long term SAAR data, is 992mm (**www.met.ie**).

The average potential evapotranspiration (PE) at Kilkenny station is taken to be 460mm (**www.met.ie**). The actual evapotranspiration (AE) is calculated to be 437mm (95% PE). Using the above figures, the effective rainfall (ER)[1] for the area is calculated to be (ER = SAAR – AE) 555mm.

3.3 GEOLOGY & HYDROGEOLOGY

The mapped soil type (**www.gsi.ie**) in the proposed site is mineral alluvium (AlluvMIN). Other soils mapped in areas surrounding the river valley include acid shallow well drained mineral soils (AminSW) and acid deep well drained mineral soils (AminDW).

The mapped subsoil type (**www.gsi.ie**) in the area of the proposed site is Alluvium (A). Other subsoils mapped locally include till derived from acidic volcanic rocks (TAv) and bedrock outcrop or subcrop (Rck).

The bedrock geology below the site is mapped as Ordovician Volcanics (OV), with the Campile Formation to the south and the Garraun Member to the north.

[1] *ER – Effective Rainfall is the excess rainfall after evaporation which produces overland flow and recharge to groundwater.*

There is one mapped fault line running through the proposed site location in a northwest – southeast orientation. The GSI map several additional fault lines in the surrounding area including a larger fault line that begins in Dunabrattin Bay and ends in Dunhill. This larger fault line remains to the west of the site, intersecting the Annestown stream and Anne Valley walkway south of the site. The bedrock geology, and associated faulting will have no influence on the design or operation of the walkway.

There are no local mapped karst or significant springs, or groundwater features that may cause groundwater flooding along the walkway. The underlying bedrock is classified as a Regionally Important Aquifer – Fissured Bedrock by the GSI (**www.gsi.ie**).

3.4 DESIGNATED SITES & HABITATS

Within the Republic of Ireland designated sites include National Heritage Areas (NHAs), Proposed National Heritage Areas (pNHAs), candidate Special Areas of Conservation (cSAC) and Special Protection Areas (SPAs). No designated sites are mapped with the proposed site boundaries.

The closest designates site is the Mid-Waterford Coast SPA (Site Code:004193), located ~950m to the south. The Anne Valley Walkway ends in Annestown on the Waterford Coast. This section of the Waterford coastline, between Newtown Cove and Ballyvoyle, is within the Mid-Waterford Coast SPA.

In addition, the Ballyvoyle Head to Tramore pNHA (Site Code:1693) is in close proximity to the Annestown Stream discharge point.

4. SITE SPECIFIC FLOOD RISK ANALYSIS

4.1 INTRODUCTION

The following assessment is carried out in accordance with '*The Planning System and Flood Risk Management Guidelines for Planning Authorities*' (DoEHLG, 2009). The basic objectives of these guidelines are to:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water run-off;
- Ensure effective management of residual risks for development permitted in floodplains;
- Avoid unnecessary restriction of national, regional or local economic and social growth;
- Improve the understanding of flood risk among relevant stakeholders; and,
- Ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management.

A Stage 1 assessment of flood risk requires an understanding of where the water comes from (*i.e.* the source), how and where it flows (*i.e.* the pathways) and the people and assets affected by it (*i.e*. the receptors). It is necessary to identify whether there may be any flooding or surface water management issues related to the proposed development site that may warrant further detailed investigation.

As per the guidance (DOEHLG, 2009), the stages of a flood risk assessment are:

- *Flood risk identification* – identify whether there are surface water flooding issues at a site; and,
- *Initial flood risk assessment* - confirm sources of flooding that may affect a proposed development.

Further to this, a Stage 2 assessment involves the confirmation of sources of flooding, appraising the adequacy of existing information and determining what surveys and modelling approach may be required for further assessment.

4.2 FLOOD ZONE MAPPING

Flood zones are geographical areas within which the likelihood of flooding is in a particular range. There are three types or levels of flood zones defined for the purposes of according to OPW guidelines:

- Flood Zone A – where the probability of flooding from rivers 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);
- Flood Zone B – where the 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); and,
- Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

4.3 FLOOD RISK IDENTIFICATION

4.3.1 Soils Maps - Fluvial Maps

A review of the soil types in the vicinity of the site was undertaken as soils can be a good indicator of past flooding in an area. Due to past flooding of rivers, deposits of transported silts/clays referred to as alluvium build up within the flood plain and hence the presence of these soils is a good indicator of potentially flood prone areas.

Based on the EPA/GSI soils map for the area it appears that entire site area is overlain by alluvium. This is consistent with the PFRA mapping which shows significant areas of land adjacent to the Annestown Stream, particularly on the western bank, located within the 100-year flood zone (Flood Zone A) and some further areas within the 1000-year flood zone (Flood Zone B).

4.3.2 Historical Mapping

The local available historic 25" and 6" Cassini mapping for the proposed site contains text identifying areas prone to flooding in the south of the site. The following text was located at approximately Chainage 0+600m indicating coastal flooding: "*Highest point to which ordinary tides flow*".

However, this in not consistent with PFRA mapping which indicates that the 1 in 200-year flood coastal flood zone does not extend as far north as the proposed site (refer to **Section 4.3.4**).

4.3.3 OPW National Flood Hazard Mapping

The OPW National Flood Hazard Maps have no records of historic or recurring flood incidences within the site boundaries (refer to **Figure C** below). The closest mapped flood events are found at the coastal end of the Anne Valley Walkway. These flooding incident records are as follows:

- The Anne River is identified in a 2006 ESB report as a location subject to flooding with the following statement "Anne River at Annestown. The river overflows due to a combination of high tides and heavy rain."
- Waterford County Council (WCC) report on coastal erosion and damage to the car park in Annestown during a storm in October 2004.
- WCC report on extensive damage along the coast, listing Annestown as a location affected, due to storm and severe fluvial flooding in December 1989.

Figure C: OPW Indicative Floods Map (www.floods.ie)

4.3.4 Preliminary Flood Risk Assessment Maps

The OPW Preliminary Flood Risk Assessment (PFRA) maps for the area Map no. 69 (www.cfram.ie/pfra/interactive-mapping/) shows that much of the proposed site is located within Fluvial 100-year flood zone (Flood Zone A) and in the Extreme Event flood zone (Flood Zone B).

The PFRA mapping indicates that land up to ~350m from the western bank of the Annestown Stream is located within the Fluvial 100-year flood zone (Flood Zone A). The section of walkway to be raised is located in close proximity to the western bank of the watercourse, and as such it is located in the 100-year flood zone for fluvial flooding. The only exception is a short section of the walkway between Ch. 0m and Ch. 100m which is not mapped within Fluvial Flood Zone A.

The flood zones indicated on the PFRA mapping are shown in **Figure D** below. The PFRA mapping does not suggests that there is a potential for pluvial flooding in any parts of the walkway.

Original PFRA mapping is attached in **Appendix I**.

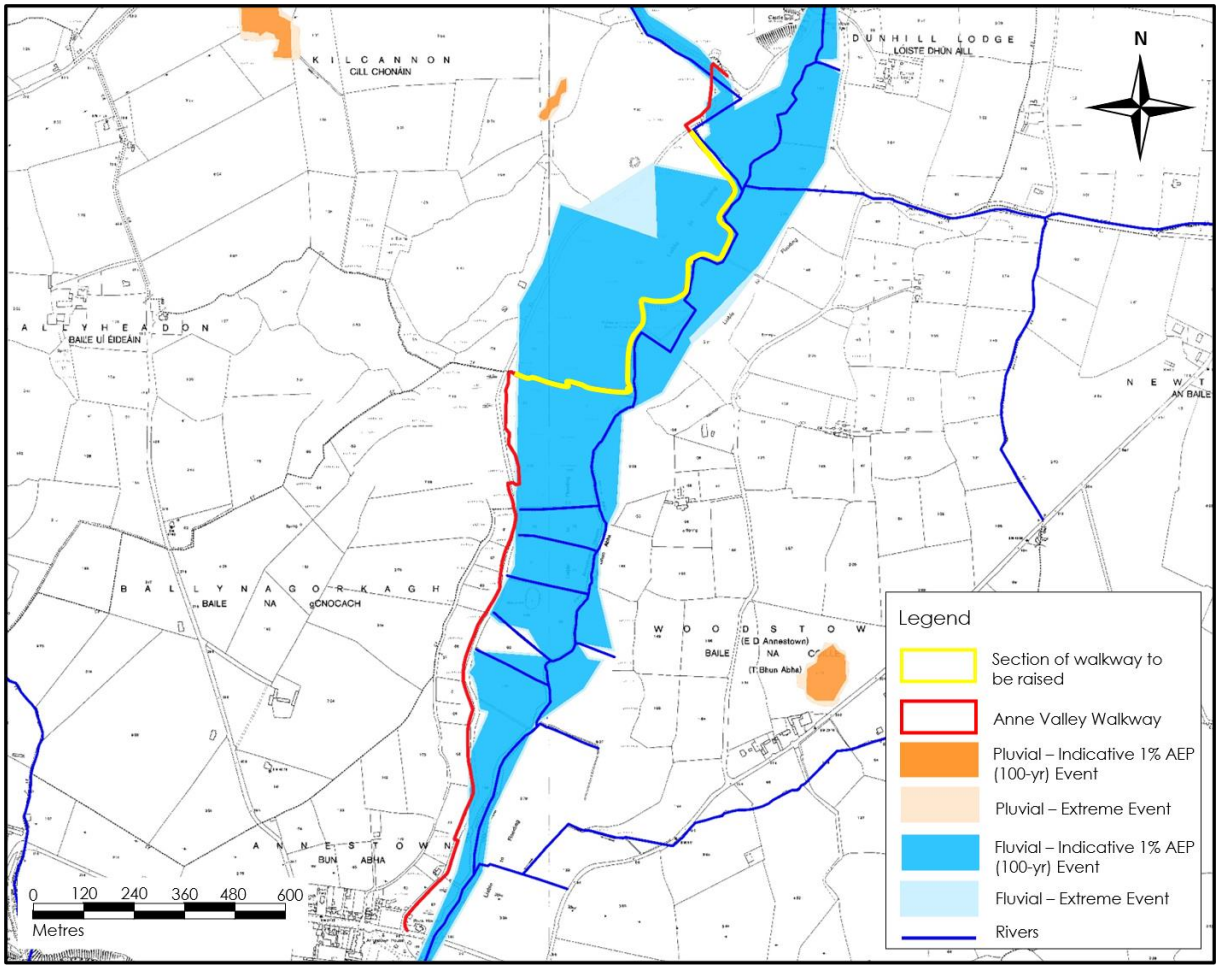


Figure D: PFRA Fluvial and Pluvial Flood Zone Mapping (Flood Zones obtained from PFRA Map no. 69)

The 200-year PFRA coastal flood zone (also Flood Zone A) overlaps with the southern portion of the Anne Valley Walkway but does not extend as far north as the section subject to this assessment. The field drains that connect to the Annestown Stream on its western bank as well as large areas to the east of the stream are mapped within the coastal Flood Zone A. These areas of indicative coastal flooding are shown in **Figure E** below but are not relevant to this proposed development.

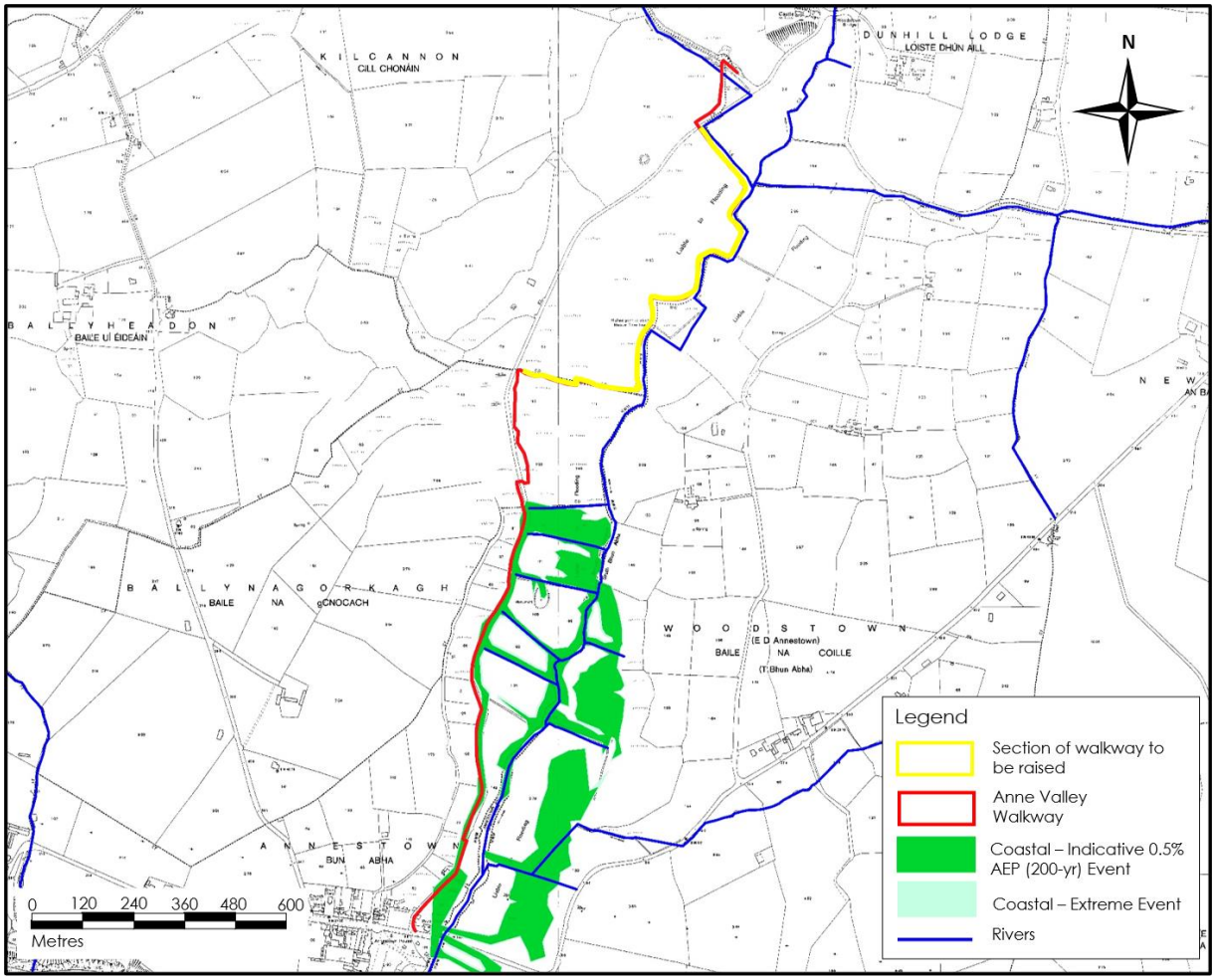


Figure E: PFRA Coastal Flood Zone Mapping (Flood Zones obtained from PFRA Map no. 69)

4.3.5 CFRAM Mapping

Where complete the CFRAM[2] OPW Flood Risk Assessment Maps are now the primary reference for flood risk planning in Ireland and supersede the PFRA maps. No CFRAM mapping is available for the area of the proposed site at the time of writing.

4.3.6 GSI Flood Mapping

The GSI Historical Groundwater and Surface Water flood maps indicate that areas to the east and south of the site experienced surface water flooding during the extreme winter 2015/2016 flood event. The GSI do not map any surface water or groundwater flood zones within the proposed development site.

4.3.7 Summary – Flood Risk Identification

Based on the information gained through the flood identification process it would appear that the majority of the proposed walkway is located in Fluvial Flood Zone A, associated with flooding along the Annestown Stream. Meanwhile coastal flooding does not extend as far north as the section of walkway subject to the assessment. The potential flood risks have been confirmed by site inspection as outlined further in **Section 4.4.1** below.

[2] *CFRAM is Catchment Flood Risk Assessment and Management. The national CFRAM programme commenced in Ireland in 2011 and is managed by the OPW. The CFRAM Programme is central to the medium to long-term strategy for the reduction and management of flood risk in Ireland.*

4.4 INITIAL FLOOD RISK ASSESSMENT

4.4.1 Site Walkover

A walkover survey of the site and the surrounding area was undertaken by HES on 02nd March 2021. While the day of the site visit was largely dry and relatively mild for early spring, the preceding week was wet with significant volumes of rainfall. The purpose of the site survey was to determine the topographic layout of the site, to investigate the hydrological regime of the area and to identify potential flood patterns and flood zones.

The primary surface water feature of the site is the Annestown Stream that flows north to south within the Anne Valley. The northern section of the walkway begins where the Ballylenane Stream crosses a local road from the west. This stream flows west to east, north of the walkway, and discharges into the Annestown stream after ~140m of the walkway route. An unnamed stream, draining a gully to the east, joins the Annestown Stream at the same location. The Annestown stream flows parallel and to the east of the walkway before the walkway turns westwards at Chainage 0+700m. An unnamed drain flows from west to east in the southern section of the walkway (from Chainage 0+710m to 0+940m) and joins the Annestown stream to the south of Chainage 0+700m. These tributaries and channels are shown in **Figure B**.

During the site walkover several surface waterbodies were noted to the west of the walkway within an area scrubland. These form part of the Anne Valley Marshland found along the Annestown Stream. While these water bodies are largely concentrated towards the northern section of the walkway, the ground lying to the west of the walkway was found to be wet with pockets of surface water noted throughout.

While the walkway was largely dry on the day of the site visit there was some evidence of recent fluvial flooding. Silt deposition found between Chainage 0+300 and 0+500m and again between Chainage 0+800 and 0+900m. In addition, small sections of the walkway were flooded at approximately Chainage 0+850m.

A selection of photographs of the site, taken during the site walkover, are attached as **Appendix II**.

Based on the site walkover survey the area of the proposed walkway route to be raised is at risk of flooding.

In addition to the above walkover, further site visits and differential GPS surveying (using a Trimble TSC7/R6-3) was completed at the site on 17th and 19th March 2021.

4.4.2 Hydrological Flood Conceptual Model

Potential flooding in the vicinity of the site can be described using the Source – Pathway – Receptor Model (S-P-R). There are two potential sources of flooding in this area with consequences for the proposed development site, fluvial flooding from the Annestown Stream and tidal flooding from Dunabrattin Bay.

Regarding fluvial flooding, the primary potential pathway would be overland flow if the Annestown Stream exceeded its bank full capacity. Potential receptors in the area are infrastructure (including roads), people and land.

Regarding coastal flooding, the primary potential pathway would be floodplain inundation due to high waves and storm surge. Potential receptors in the area are infrastructure (including roads), people, property and land. However, due to the wide valley bottom and gentle slope, it will take a large volume of flood water to raise the water level in the area subject to this application by any significant degree.

Groundwater and pluvial flooding are not considered to be issues along the walkway route.

4.4.3 Summary – Initial Flood Risk Assessment

Based on the information gained through the flood identification process and Initial Flood Risk Assessment process the sources of flood risk for the proposed walkway route are outlined and assessed in **Table A**.

Table A: S-P-R Assessment of Flood Sources for the Proposed Site

Source	Pathway	Receptor	Comment
Fluvial	Overbank flooding from the Annestown Stream.	Land, People, Infrastructure	The section of walkway to be raised is mapped to be within the 100-year flood zone of the Annestown Stream. However, due to the recreational nature of the walkway it will not likely be used during heavy rainfall events. Raising the walkway from its current elevation, will reduce the fluvial flood risk along the walkway.
Tidal	Floodplain inundation due to high waves and storm surge from Dunabrattin Bay.	Land, People, Infrastructure, Property	There is little risk of coastal flooding along the section of walkway to be raised due to its distance from Dunabrattin Bay and the gently sloping valley floor. Raising the walkway from its current elevation, will further reduce the coastal flood risk in this section of the Anne Valley Walk.
Pluvial	Ponding of rainwater on site	Land, People, Infrastructure, Property.	No risk of pluvial flooding on the proposed walkway with no areas identified as vulnerable to pluvial flooding during site inspection.
Surface water	Surface ponding/ Overflow	Land, People, Infrastructure, Property.	No risk of surface ponding/overflow on the walkway route as stated above.
Groundwater	Groundwater levels	Land, People, Infrastructure, Property.	Not an issue at along this proposed walkway route.

5. DETAILED FLOOD IMPACT ASSESSMENT

5.1 FLOOD DISPLACEMENT ASSESSMENT

This section assesses the flood risk of the proposed development with regard to Section 5.28 of the Flood Risk Management Guidelines. The assessment is made based on the PFRA fluvial flood zone mapping as this is currently the only available published flood mapping for the development site.

As seen in **Figure D** , the section of the Anne Valley walkway subject to this application is mapped within the PFRA 1 in 100-year and 1 in 1,000-year fluvial flood zones. Therefore, the current Anne Valley Walkway at this location is submerged beneath flood water during such fluvial flood events. The proposed raising of a section of the walkway will displace this flood water, increasing the flood risk elsewhere in the vicinity of the development. The following paragraphs attempt to quantify the volume of flood water which will be displaced by the proposed raising of the walkway.

The raised footpath and associated embankments have a combined footprint of ~4,255m^2 and an approximate fill volume of ~2,800m^3. The current ground on which the new raised pathway will be placed has an average elevation of ~2.0 mOD. The actual volume of flood storage removed by raising the pathway will vary depending on the water level associated with the flood event.

1m DSM elevation data was obtained for the Anne Valley and allowed the extent of fluvial flooding to be derived for a range of water levels (refer to **Table B**). For example, for the current "baseline" conditions with the path at current ground level, a fluvial flood event with a water level of 2.50 mOD, has a total flood volume of approximately 248,953.68m^3 and a flooded extent of 400,246m^2. Following the proposed raising of the pathway, the available flood volume would decrease to 246,924.23m^3. For a flood level of 2.5mOD the actual volume of flood storage removed by raising the pathway is 248,953.68m^3 – 246,924.23m^3 = 2,029.45m^3. The plan area of the flooded extent of the Annestown Stream in the immediate area surrounding the Site is 396,932m^2 (~39.69 Ha).

If you spread the removed flood volume (from the raising of the walkway) across the flooded extent of the Annestown Stream floodplain for such a flood event, you get a water level increase of 5.1mm [(2,029.45m^3/ 396,932m^2) *1,000).

Similarly, for a fluvial flood event with a water level of 3 mOD, the Annestown Stream has a total flood volume of approximately 477,634.55m^3 and a flooded extent of 503,113m^2. Following the proposed raising of the pathway, the available flood volume would decrease to 474,905.92m^3. The plan area of the flooded extent of the Annestown Stream in the immediate area surrounding the Site is 502,929m^2 (~50.29 Ha). Therefore, the actual volume of flood storage removed by raising the pathway is 477,634.55m^3 – 474,905.92m^3 = 2,728.63m^3 This would result in a water level increase of 5.4mm across the flooded extent of the Annestown Stream.

A series of similar volume displacement calculations are presented in **Table B**, and these illustrate the negligible impact the presence of the raised path would have on flood levels across the valley through a range of potential flood events.

Table B: Flood Impact Assessment Calculations for Raised Walkway

Flood Level (mOD)	Baseline Flood Volume (m^3)	Baseline Flood Area – Plan View (m^2)	Post development Flood Volume (m^3)	Post development Flood Area (m^2)	Water Level Increase (mm)
3.00	477,634.55	503113	474905.92	502929	5.4
2.75	356,911.34	459956	354200.93	457940	5.9
2.50	248,953.68	400246	246924.23	396932	5.1
2.25	158,368.34	318311	157211.95	314574	3.7
2.00	90,198.02	232668	89879.918	230477	1.4
1.75	43,874.22	125685	43826.527	125467	0.4
1.50	22,741.40	56360	22703.825	56499	-

Therefore, as the magnitude of the flood event increases a greater proportion of the raised path will be located in the flood zone, increasing the volume of displaced floodwaters (**Figure F**). For example, no increase in water level will be recorded for an event with a water level of 1.5mOD as none of the walkway will be located in a flood zone. Higher magnitude events such as a flood level of 2.75mOD will result in a water level increase of 5.9mm. Therefore, even for extreme flood events the volume of flood water displaced will be spread out over such a large area that it will result in an insignificant water level increase across the floodplain of the Annestown Stream.

Based on the above, the proposed raising of the walkway will have negligible effect on local flood risk.

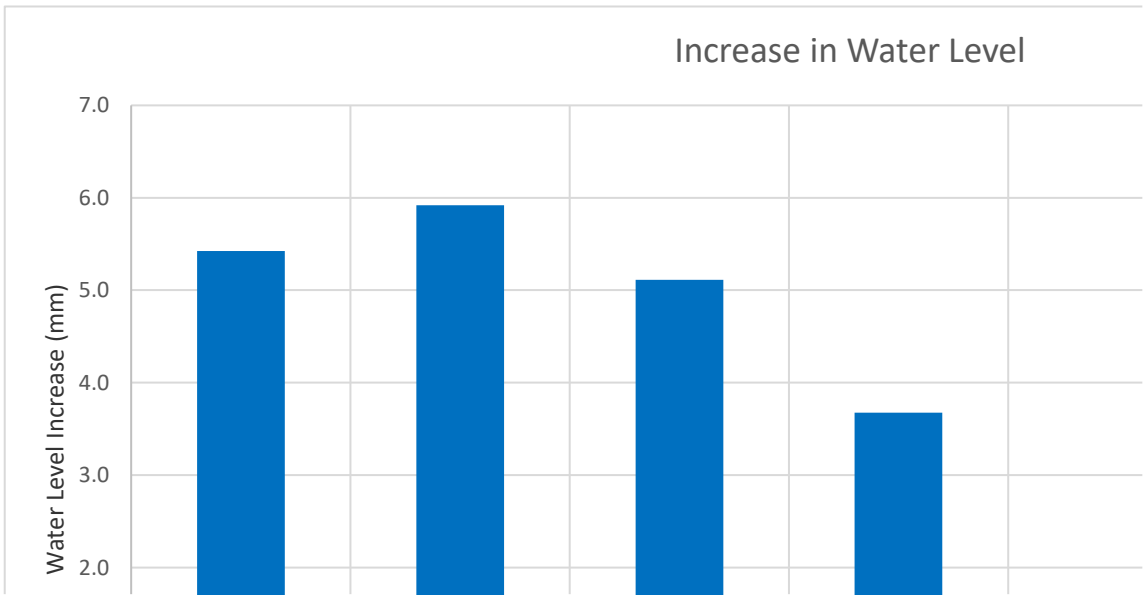


Figure F: Water level increase for a range of flood events

5.2 PLANNING POLICY AND CDP

The following policies are defined in Waterford County Council CDP 2011-2017 (**Table C**) in respect of flooding, and we have outlined in the column to the right how these policies are provided for within the proposed development design:

Table C: Waterford County Council Planning Policy and Responses

No.	Policy	Development Design Response
ENV 16	It is the policy of Waterford County Council that flood risk be managed pro-actively at all stages in the planning process, by avoiding development in flood risk areas where possible, and by reducing the causes of flooding to and from existing and future development.	The FRA was commissioned in recognition of the need to manage flood risk appropriately in the planning process. The proposed walkway is considered a water-compatible development.
ENV 17	The Council will have regard to the policies and guidelines of the DoEHLG and OPW in floodplains and areas sensitive to flooding.	As stated in Section 1, this FRA has been prepared in accordance with '*The Planning System and Flood Risk Management Guidelines for Planning Authorities*'.
No.	**Objective**	**Development Design Response**
ENV 7	It is an objective to protect floodplains of river catchments in the County and retain them for their flood protection and natural heritage values.	The proposed walkway sustains public enjoyment of the Annestown Stream's natural heritage values. Through the proposed raising of the walkway, the flood protection value of the watercourse will not be impeded.
ENV 8	It is an objective to identify and consider flood hazard and potential risk of flooding in development applications at the earliest stages in the planning process and require the preparation of a Flood Risk Assessment where necessary.	This FRA identifies the flood hazard associated with the proposed walkway in accordance with this objective.
ENV 9	It is an objective to continue to support the preparation of all CFRAM Studies including the River Suir, South Eastern RBD CFRAM Study and South Western RBD CFRAM Study and incorporate measures to manage flood risk identified in these studies.	The Annestown Stream is not included in the CFRAM studies to date.
ENV 10	It is an objective to include a Strategic Flood Risk Assessment for the County Development Plan and Local Area Plans.	This FRA is consistent with the site-specific requirements of the "Planning System and Flood Risk Management – Guidelines for Planning Authorities".
ENV 11	It is an objective to apply the sequential approach set out in the DoEHLG Guidance on Flood Risk to all future zoning of land for development.	This FRA is consistent with the sequential approach set out in the DoEHLG Guidance on Flood Risk.
ENV 12	It is an objective to promote the use of SUDS in mitigating the effects of flood risk in both urban and rural areas subject to flood risk.	Use of SUDs or significant drainage controls for this proposed development are not required.

5.3 JUSTIFICATION TEST

The matrix of vulnerability versus flood zone to illustrate appropriate development and that required to meet the Justification Test is shown in **Table D**. The majority of the proposed walkway is located in either Fluvial or Coastal Flood Zone A according to PFRA mapping.

It may be considered that the proposed development is 'Water-compatible' – Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms'. Therefore, the development of this walkway does not require a Justification Test[3].

Table D: Matrix of Vulnerability versus Flood Zone

	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

Note: Taken from Table 3.2 (DoEHLG, 2009)
***Bold:** Applies to this project.*

[3] *A 'Justification Test' is an assessment process designed to rigorously assess the appropriateness, or otherwise, of particular developments that are being considered in areas of moderate or high flood risk, (DoEHLG, 2009).*

6. REPORT CONCLUSIONS

6.1 CONCLUSIONS

- A flood risk identification study was conducted to identify potential flood risk associated with the proposed raising of a section of the Anne Valley Walkway;
- From this study:
    - The Preliminary Flood Risk Assessment (PFRA) mapping indicates that the proposed section of the Anne Valley walkway route to be raised is located within the 100-year Fluvial flood zone (Flood Zone A).
    - The site is not mapped within the PRFA Coastal flood zones;
    - Available anecdotal information and site observations indicate that the section of pathway to be raised has flooded several times in the past.
- Due to the recreational nature of the walkway, it is generally avoided by the public during heavy rainfall and storm events. During flood events, the walkway is inaccessible to members of the public until the flood water recedes. In this way, the consequences of the walkway flooding are low;
- It may be considered that the proposed activity is a 'Water-compatible development – amenity open space, outdoor sports and recreation and essential facilities such as changing rooms'. Therefore, the proposed walkway development does not require a Justification Test;
- The raising of a section of the walkway is unlikely to have any significant impact on flooding elsewhere in the Annestown Stream catchment due to its large scale and the large volume of water associated with these flood events. When spread over the extent of fluvial flooding, the volume of flood water displaced by the proposed development is negligible;
- Placement of regular culverts at low points along the proposed raised walkway will maintain the exiting drainage pathways, and further limit the flood impacts in the area around the raised walkway by allowing flood water to drain freely over and back between the east and west of the raised walkway as required; and,
- As outlined in Section 5.2 above, the proposed development is consistent with the relevant planning objectives and standards from the Waterford County Council 2011-2017.

* *

7. REFERENCES

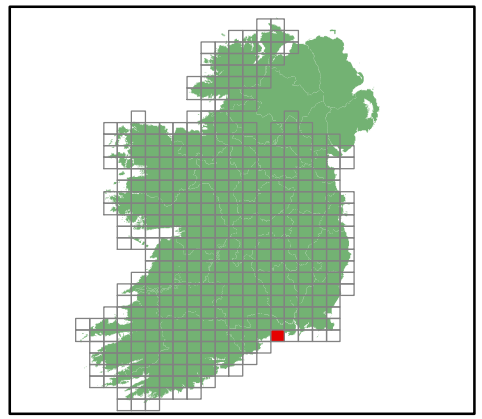
AGMET	1996	Agroclimatic Atlas of Ireland.
DOEHLG	2009	The Planning System and Flood Risk Management.
Met Eireann	1996	Monthly and Annual Averages of Rainfall for Ireland 1961-1990.
GDSDS	2005	Greater Dublin Strategic Drainage Study (http://www.greaterdublindrainage.com/gdsds/)
OPW	2011	Preliminary Flood Risk Assessment Maps
WCDP	2011	Waterford County Development Plan (CDP) 2011-2017

Appendix I: PFRA Mapping

Site Boundary

0.5 0.25 0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 Kilometers

Location Plan :



Legend:

Flood Extents

- Fluvial - Indicative 1% AEP (100-yr) Event
- Fluvial - Extreme Event
- Coastal - Indicative 0.5% AEP (200-yr) Event
- Coastal - Extreme Event
- Pluvial - Indicative 1% AEP (100-yr) Event
- Pluvial - Extreme Event
- Groundwater Flood Extents
- Lakes / Turloughs

PFRA Outcomes

- Probable Area for Further Assesment
- Possible Area for Further Assesment

Important User Note:

The flood extents shown on these maps are based on broad-scale simple analysis and may not be accurate for a specific location. Information on the purpose, development and limitations of these maps is available in the relevant reports (see www.cfram.ie). Users should seek professional advice if they intend to rely on the maps in any way.

If you believe that the maps are inaccurate in some way please forward full details by contacting the OPW (refer to PFRA Information leaflets or 'Have Your Say' on www.cfram.ie).

Office of Public Works
Jonathon Swift Street
Trim
Co Meath
Ireland

Project :
PRELIMINARY FLOOD RISK ASSESMENT (PFRA)

Map :
PFRA Indicative extents and outcomes
- Draft for Consultation

Figure By : PJW Date : July2011

Checked By : MA Date : July 2011

Figure No. : 2019 / MAP / 69 / A

Revision 0

Drawing Scale : 1:50,000 Plot Scale : 1:1 @ A3

Appendix II: SITE PHOTOGRAPHS – 02/03/2021

1. Ch. 0m looking east


2. Ch. 50m looking north


3. Ch. 250m looking north


4. Ch. 350m looking northwest

5. Ch. 480m looking east

6. Ch. 800m looking east

7. Ch. 850m looking south

8. Ch. 940m looking east

22 Lower Main Street, Dungarvan, Co. Waterford, X35 HK11
T: +353-(0)58-441 22 **F:** +353-(0)58-442 44 **E:** info@hydroenvironmental.ie

www.hydroenvironmental.ie