Killinarden Park & GI Corridor Flood Risk Assessment

Draft Report

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Contract

This report describes work commissioned by Nicholas de Jong Associates, on behalf of Nicholas de Jong, by a letter dated 13th March 2020. Nicholas de Jong Associates' representative for the contract was Nicholas de Jong. Anastasiya Ilyasova and Ross Bryant of JBA Consulting carried out this work.

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Purpose

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Abbreviations

1D	One Dimensional (modelling)
2D	Two Dimensional (modelling)
AEP	Annual Exceedance Probability
CFRAM	Catchment Flood Risk Assessment and Management
DoEHLG	Department of the Environment, Heritage and Local Government
FARL	FEH index of flood attenuation due to reservoirs and lakes
FB	Freeboard
FFL	Finish Floor Levels
FRA	Flood Risk Assessment
FSR	Flood Studies Report
FSU	Flood Studies Update
GSI	Geological Survey of Ireland
LHB	Left Hand Bank
OPW	Office of Public Works
PFRA	Preliminary Flood Risk Assessment
RFI	Request for Further Information
RHB	Right Hand Bank
RR	Rainfall-Runoff
SAAR	Standard Average Annual Rainfall (mm)
SFRA	Strategic Flood Risk Assessment
URBEXT	FEH index of fractional urban extent
WL	Water Level

1 Introduction

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

1.1 Terms of Reference and Scope

JBA Consulting was appointed by Nicholas DeJong Associates to carry out a Flood Risk Assessment (FRA) for a Killinarden Park redesign in Tallaght, Dublin.

1.2 Flood Risk Assessment; Aims and Objectives

This study is being completed to inform the future development of the site as it relates to flood risk. It aims to identify, quantify and communicate to Planning Authority officials and other stakeholders the risk of flooding to land, property and people and the measures that would be recommended to manage the risk.

The objectives of this FRA are to:

- Identify potential sources of flood risk;
- Confirm the level of flood risk and identify key hydraulic features;
- Assess the impact that the proposed development has on flood risk;
- Develop appropriate flood risk mitigation and management measures which will allow for the long-term development of the site.

Recommendations for development have been provided in the context of the OPW / DECLG planning guidance, "The Planning System and Flood Risk Management". A review of the likely effects of climate change, and the long-term impacts this may have on any development has also been undertaken.

For general information on flooding, the definition of flood risk, flood zones and other terms see 'Understanding Flood Risk' in Appendix A.

1.3 Development Proposal

The client is applying for planning permission for a park development located in Tallaght, Dublin.

The proposed design of the park area is presented on Figure 1-1. This includes upgrading the Killinarden Park and Green infrastructure corridor with landscaped pedestrian/cycle routes between Killindarden Park and Sean Walsh Park.

1.4 Report Structure

Section 2 of this report gives an overview of the study location and associated watercourses. Section 3 contains background information and initial assessment of flood risk. Site-specific mitigation measures are outlined in Section 4, while conclusions are provided in Section 5.

Figure 1-1: Proposed site development

2 Site Background

This section describes the proposed park development in Killinarden, Dublin, including watercourses, geology and wider geographical area.

2.1 Location

The proposed site location is shown in Figure 2-1. The site is located in south west at the edge of Dublin -Tallaght in Killinarden Park also known as Donomore Green. The park is located between N81, Whitestown Way and Killinarden Hights. Killinarden Way is crossing the site. The site is bounded by housing estates and public buildings such as schools.

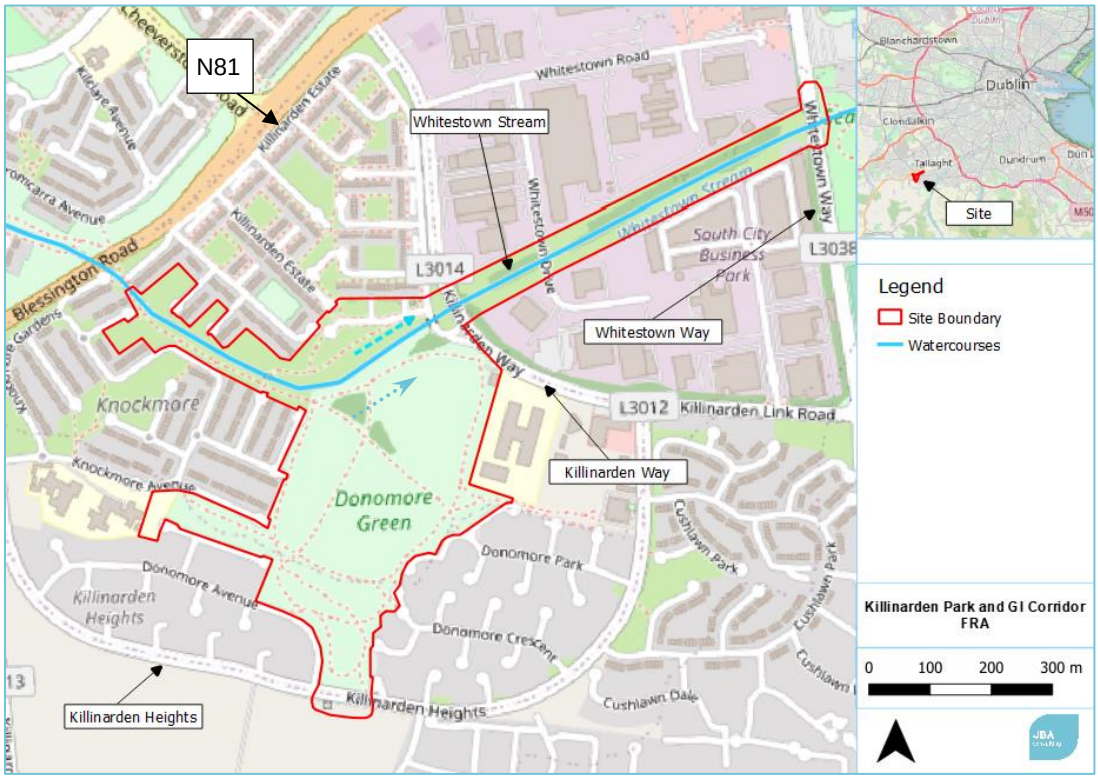


Figure 2-1: Site Location

2.2 Watercourses

The Whitestown Stream flows in an easterly direction through the north of the park, and discharges to the River Dodder c. 3km downstream. The site also has existing drainage network as shown on Figure 2-2, and a shallow conveyance channel along the western boundary of the site.

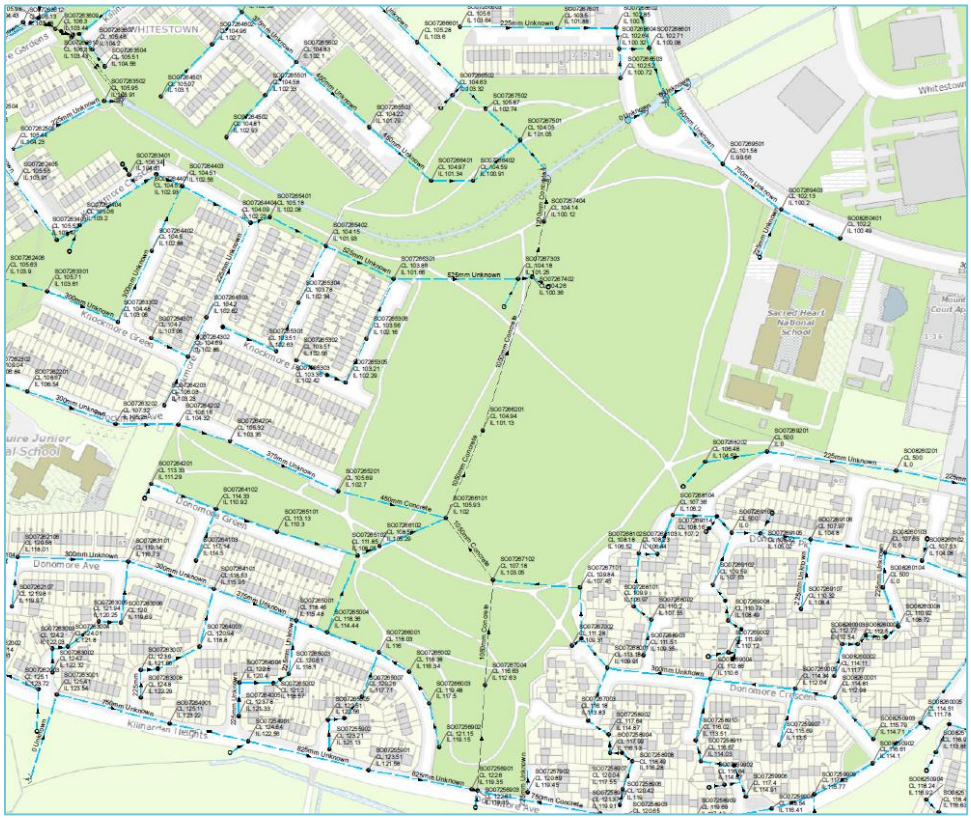


Figure 2-2: Drainage system

2.3 Local Site and Topography

The site covers an area of c. 25 hectares. The overall slope of the land is to the southeast, with the highest pot 124mOD and lowest - 94mOD. The Whitestown Stream flows through low lying areas of the site. The contours/falls from the site survey are presented in Figure 2-3. Review of Figure 2-3 confirms that there are no localised depressions within the site. The fall within the site primarily lead to the stream running through the site.

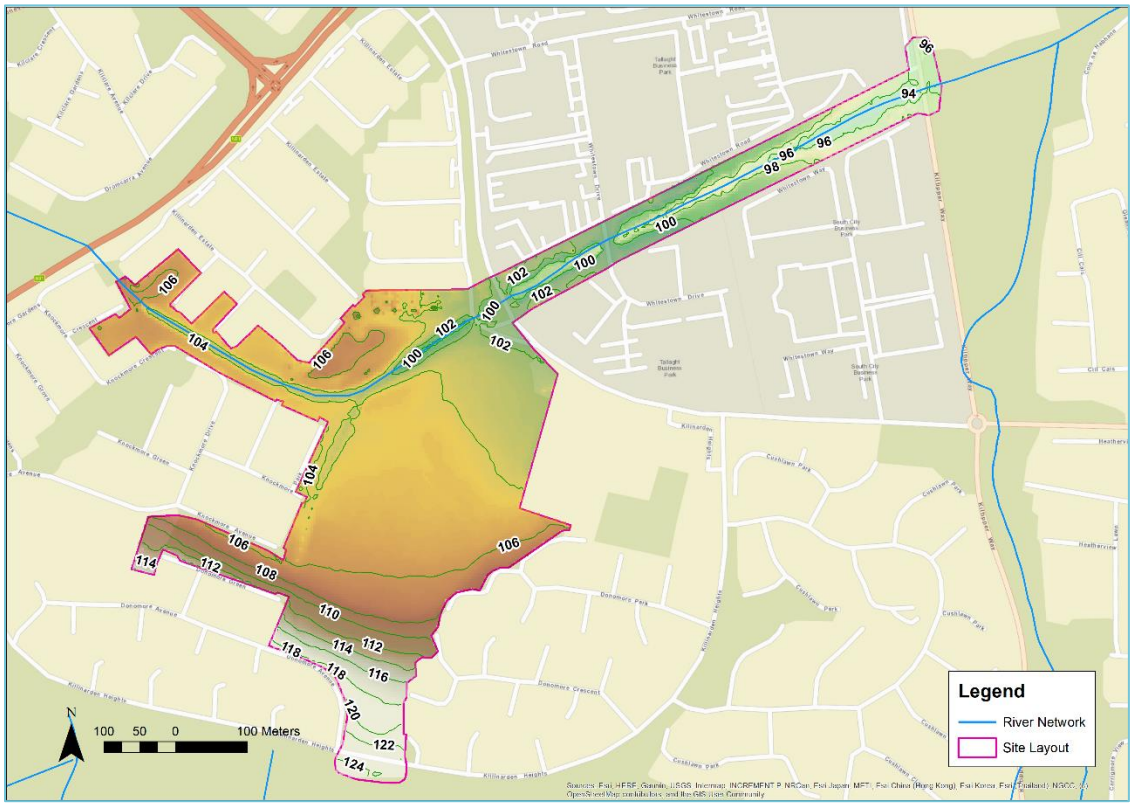


Figure 2-3: Site topology

2.4 Site Geology

The Geological Survey of Ireland (GSI) groundwater and geological maps of the site were reviewed. The subsoil present under the site is Made ground with a small patch of Till derived from Sandstone and Shale (TLPSsS) at the east border and bound at south border, refer to Figure 2-4.

The underlying bedrock is classified as the Calp Limestone - Lucan Formation, which is described as dark grey to black limestone and shale.

The associated groundwater vulnerability is classified as 'Low' for the site which indicates that a low risk to the groundwater under the site and a bedrock depth over 10m. These classifications are based on relevant hydrogeological characteristics of the underlying geological materials.

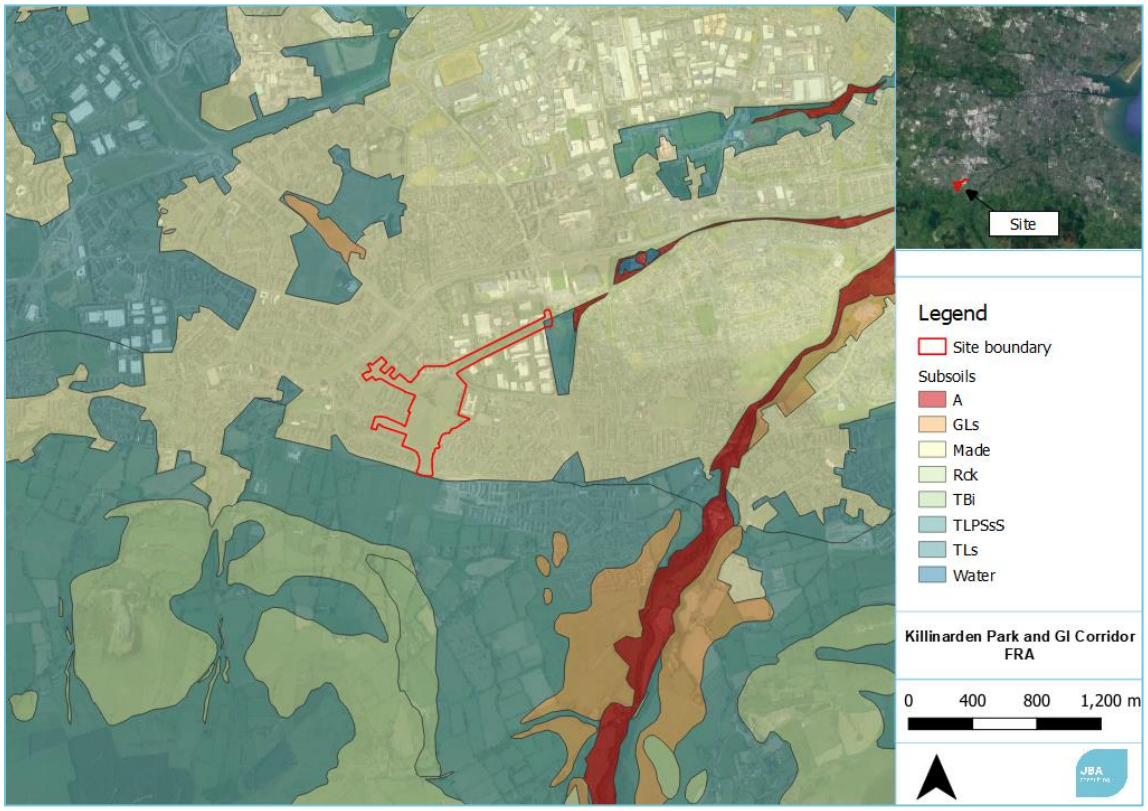


Figure 2-4: Site Subsoils

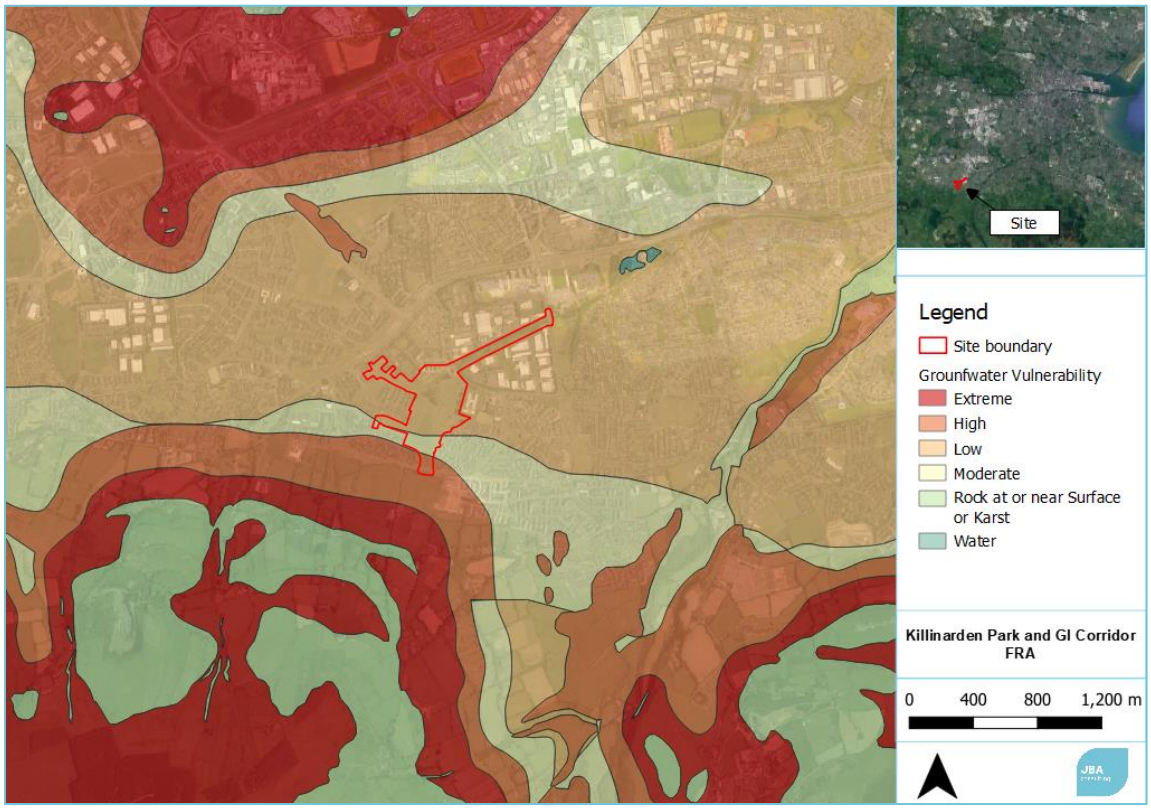


Figure 2-5 Groundwater vulnerability

3 Flood Risk Identification

An assessment of the potential for and scale of flood risk at the site is conducted using historical and predictive information. This identifies any sources of potential flood risk to the site and reviews historic flood information. The findings from the flood risk identification stage of the assessment are provided in the following sections.

3.1 Flood History

A number of sources of flood information were reviewed to establish any recorded flood history at, or near the site. This includes the OPW's website, http://www.floodinfo.ie and general internet searches.

3.1.1 Floodinfo.ie

The OPW host a National Flood Information Portal, www.floodinfo.ie, which highlights areas at risk of flooding through the collection of recorded data and observed flood events. See Figure 3-1 for historic flood events in the area.

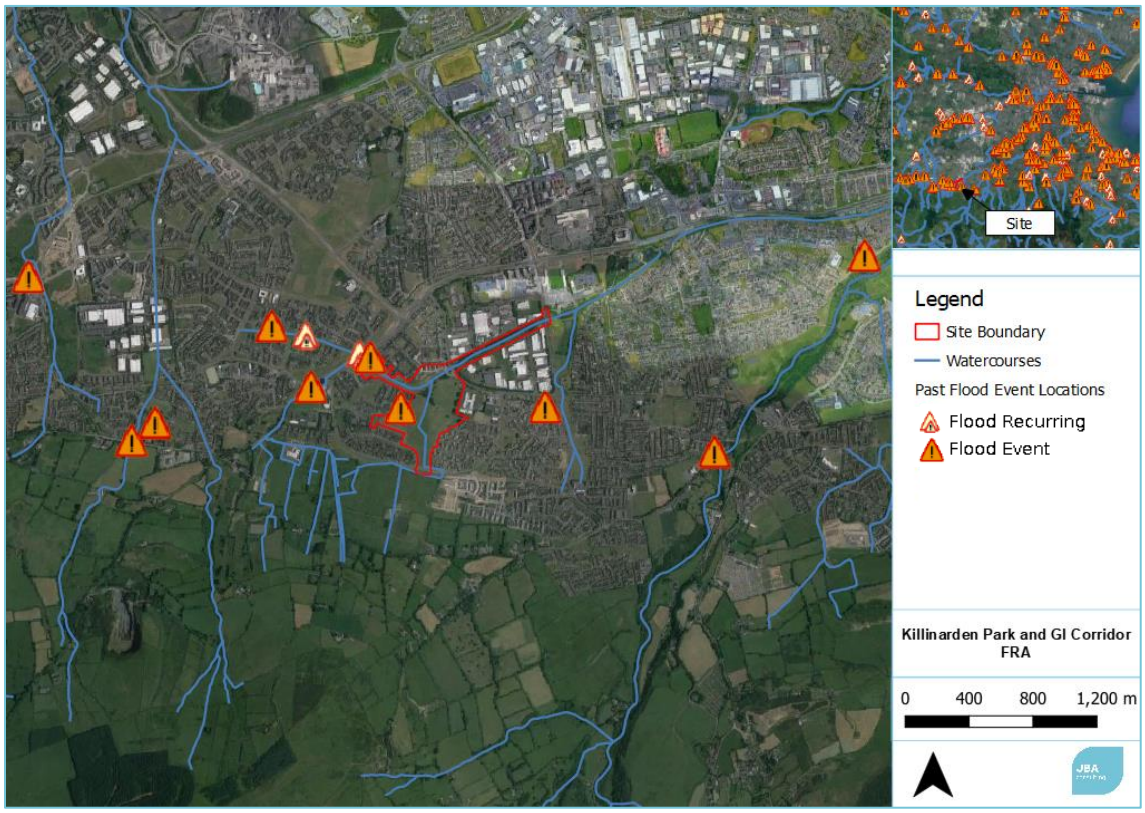


Figure 3-1: Floodmaps.ie

Review of Figure 3-1 shows number of recurring and historic floods within and outside site boundary. The most significant recorded event happened on 24th October 2011 occurred within the site area:

- Flooding in Knockmore, Tallaght. According to information extracted from a Flood Data Collection form submitted to the Office of Public Works (OPW) by Consultants working on the Eastern River Basin District (RBD) Catchment Flood Risk Assessment and Management (CFRAM) Project, "The source of the flood waters was reported to be run-off from park lands/overland flows and overflow from a culverted watercourse adjacent to the area" with max. flood depth 0.2m and between 30-70 properties impacted by the flood, c. 300m of the Knockmore Park Road and 100m of Knockmore Avenue were affected by the flood. An approximate flood outline is shown in Figure 3-2.

Figure 3-2: Approximate flood extent on 24th October 2011 (source: floodinfo.ie)

- Flooding at Tallaght Pass, N81. According to information extracted from a Flood Data Collection form submitted to the Office of Public Works (OPW) by Consultants working on the Eastern River Basin District (RBD) Catchment Flood Risk Assessment and Management (CFRAM) Project, "The source of the flood waters was the tributaries of the Camac River, which was overtopped". The flood depths reported were typically 0.5m, with the maximum being 1.2m. 110 nr properties were flooded due to flood flows along the N81 Tallaght Pass. One kilometre of the Tallaght Bypass was affected by this event. An approximate flood extent is shown in Figure 3-3.

  A shallow channel now runs along the existing western boundary of the park, which appears to have been constructed post 2011 to intercept surface water flowing towards the Knockmore Estate and instead convey it to the Whitestown Stream.

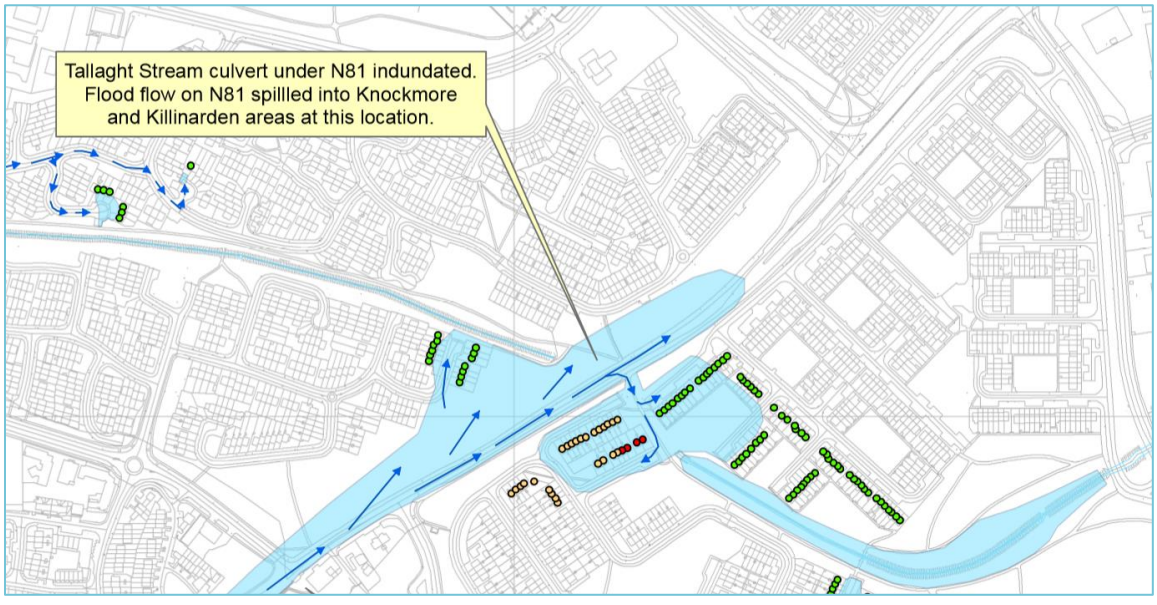


Figure 3-3: Approximate flood extent on 24th October 2011 (source: floodinfo.ie

In the "Source Meeting Minutes" report from 29/04/2005, the Killinarden Stream has been identified as area of current persistent flooding.

A number of flood events happened in the near area on 24th October 2011 and 1st May 2012:

- 1st May 2012 - Jobstown Inn, Blessington Road, Tallaght. "The source of the flood waters was the Jobstown Stream. The culvert screen at this location was blocked. One commercial building flooded as a result of this event."
- 24th October 2011 - Bawnlea Crescent and Bawnlea Avenue, Tallaght. " The Tallaght Stream outfall was blocked, which caused water to flood out on to Jobstown Road. The floodwater followed the topography and flowed through Bawnlea Crescent and Bawnlea Avenue. Water built up behind anti-joyriding barriers. Stone blocked the culvert under Jobstown Road." Typical Flood depth was 0.1m.
- 24th October 2011 - Whitestown Way, Tallaght. "Flooding was caused by the inundation of surface water drainage. Residents stated that water flowed up from the gullies and combined with the heavy rainfall caused water to pool in the backyard of this property. The water level then rose and flooded the property. A large warehouse at the back of the store was affected by this event. 40m of Killtiper Way (Urban) was affected by this event. " Typical flood depth was 0.6m.

3.1.2 Internet Searches

An internet search was conducted to find more additional information. Various reports and articles were found addressing the flooding on 24th October 2011 in Killinarden Park and surrounding area. A number of other flood events were also recorded by the media:

- 8th December 2000 caused by heavy rainfall. The N81 at Killinarden was affected by this event.1
- 12th August 2008 - "Surface water and debris on the Killinarden side of the Killtipper Road at "a very bad bend" caused delays to motorists".2

1 https://www.irishtimes.com/news/dublin-areas-flooded-due-to-heavy-rain-1.1120050
2 https://www.rte.ie/news/2008/0812/106891-weather/

3.2 Predictive Flooding

The area has been a subject of three predicative flood mapping or modelling studies and other related studies and plans:

- OPW Preliminary Flood Risk Analysis (PFRA)
- Dodder Catchment Flood Risk Assessment and Management Study (CFRAM)
- Strategic Flood Risk Assessment for South Dublin County Council Development Plan 2016-2022

The level of detail presented by each method varies according to the quality of the information used and the approaches involved.

3.2.1 OPW PFRA

The preliminary Flood Risk Assessment (PFRA) is a requirement of the EU Flood Directive (2007/60/EC). One of the PFRA deliverables is flood probability mapping for various sources: pluvial (surface water), groundwater, fluvial and tidal. The PFRA is a preliminary or 'indicative' assessment and analysis has been undertaken to identify areas potentially prone to flooding. The OPW PFRA study has been superseded by the latest CFRAM mapping.

The PFRA mapping is currently being updated and as of 11/02/2021, the updated PFRA maps are not available.

3.2.2 Dodder Catchment Flood Risk Assessment and Management Study

The primary source of data with which to identify flood risk to the site is the Dodder CFRAM. Flood maps have been finalised for Whitestown Stream and an extract of the flood map covering the site and surrounding area are presented in Figure 3-4. The final flood maps for the 10%, 1% and 0.1% AEP are publicly available. Review of Figure 3-4 indicates that most of the site is within Flood Zone C, and therefore has a low probability of fluvial flooding, however, small area, where the transport infrastructures fall within the site boundary falls within Flood Zone B with moderate probability of flooding.

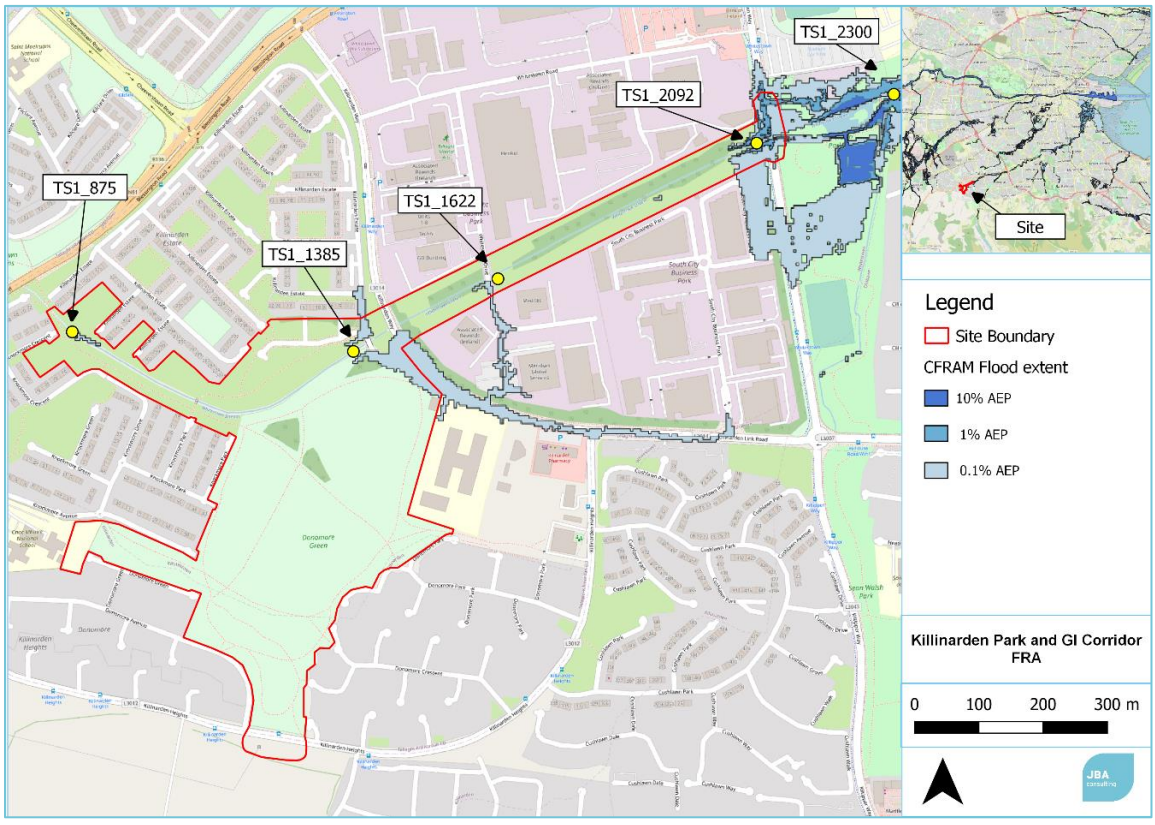
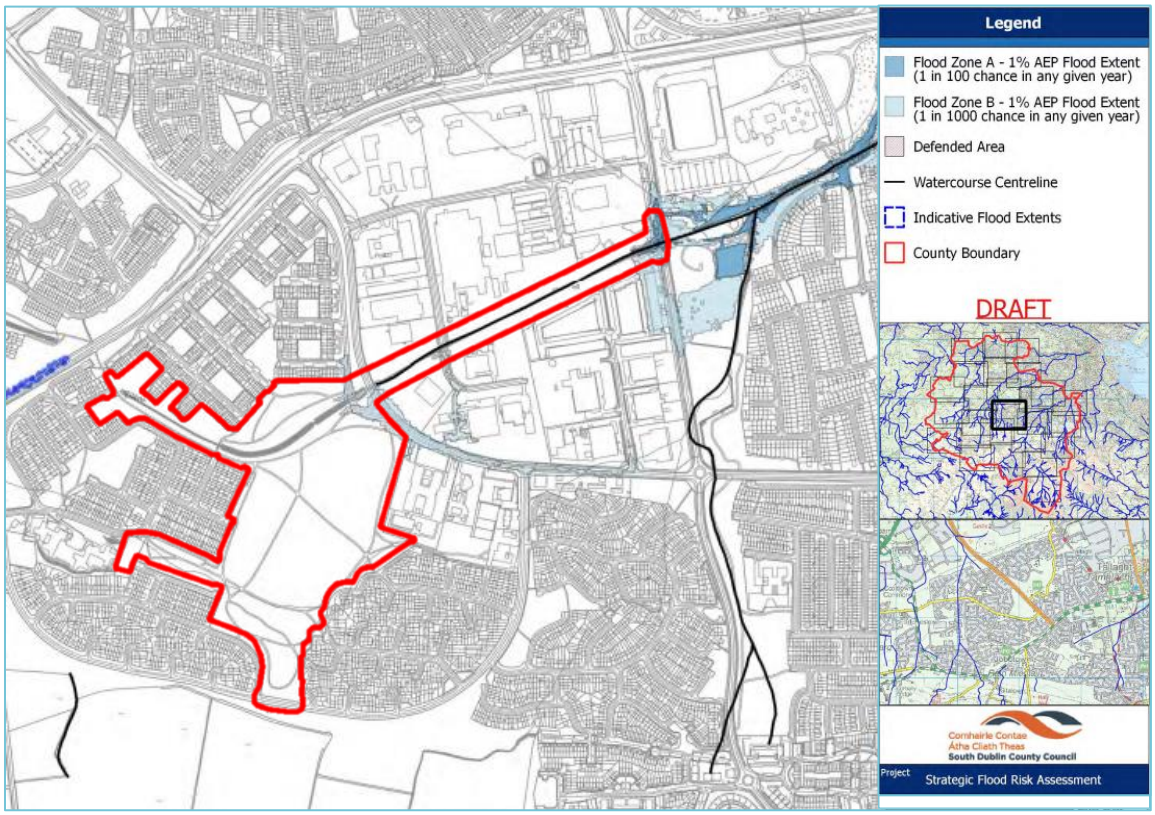


Figure 3-4: Dodder CFRAM fluvial Flood Extent Map

3.2.3 Strategic Flood Risk Assessment for South Dublin County Council Development Plan 2016-2022

In accordance with the Planning and Development Act 2000 South Dublin County Council (SDCC) commenced a review the existing 2010-2016 County Development Plan and the preparation of a new County Development Plan for the period 2016–2022 in September 2014. A SFRA for the South Dublin County Development Plan 2016-2022 was prepared in accordance with the requirements of The Planning System and Flood Risk Assessment Guidelines for Planning Authorities (2009) and Circular PL02/2014 (August 2014). The SFRA provides an assessment of all types of flood risk within the County and assisted SDCC to make informed strategic land-use planning decisions and formulate flood risk policies. A Stage 1 Flood Risk Identification was undertaken to identify any flooding or surface water management issues related to the County that may warrant further investigation. As part of this stage the best available data at the time of preparation was acquired from the Office of Public Works (OPW) Eastern Catchment Flood Risk Assessment Management (CFRAM) Study. The Eastern CFRAM has generated draft flood zone mapping which has been deemed suitable as a Stage 2 Initial Flood Risk Assessment. This flood risk information has enabled SDCC to apply 'The Guidelines' sequential approach, and where necessary the Justification Test, to appraise sites for suitable land zonings and identify how flood risk can be managed as part of the development plan. The flood outline for the site area in the SFRA is the same as in Dodder CFRAM, reviewed in the previous paragraph.



3.3 Flood Sources

The initial stage of a Flood Risk Assessment requires the identification and consideration of probable sources of flooding. Following the initial phase of this Flood Risk Assessment, it is possible to summarise the level of potential risk posed by each source of flooding. The flood sources are described below.

3.3.1 Fluvial

Fluvial flooding is the result of river levels rising and flowing out of bank, across lands that are usually dry. Most of the site is within Flood Zone C, and therefore has a low probability of fluvial flooding, however, small area, where the transport infrastructures fall within the site boundary are within Flood Zone B with moderate probability of flooding.

3.3.2 Tidal

The site is located far from the tidal areas and therefore has no risk of tidal flooding.

3.3.3 Pluvial/ Surface Water

Pluvial flooding is the result of rainfall-generated overland flows that arise before run-off can enter a watercourse or sewer. Review of the past flood events information indicates that the site is at low risk inundation, however the housing estate was affected by the flows coming from the site area in 24th October 2011. Further discussions on pluvial flood risk are provided in Section 4.2.1.

3.3.4 Groundwater

Groundwater flooding results from high sub-surface water levels that impact upper levels of the soil strata and overland areas that are usually dry. The GSI groundwater vulnerability for the site is classified as Low, which indicates the bedrock is approximately 10m from the surface. There are no further indicators that groundwater flooding is a significant risk. The risk of groundwater flooding has been screened out at this stage.

4 Flood Risk Assessment

4.1 Flood Risk

The proposed development site is located within Flood Zone C. This means the probability of flooding from rivers is low (less than 0.1% or 1 in 1000 for both rivers). The main flood risk has been identified as the surface water runoff coming from the south part of the site during the heavy rainfall events, which inundate the housing estate to the west (see Figure 3-2).

4.2 Mitigation Measures

4.2.1 Stormwater Design/Pluvial Flooding

The park currently drains naturally to the Whitestown Stream. Large box culverts accommodate an overland conveyance route to the Stream. The bed of the stream comprises mainly a concrete trapezoidal channel. The stream is subject to regular littering and dumping, most of which culminates in and around the Whitestown Business Park downstream. A local group of volunteers meet on a regular basis to remove litter from the stream.

To manage overland flows through the park, an interception trench to intercept runoff from the Tallaght Hills has been proposed within the proposed development to the south. The trench is designed for upto the 30 year rainfall event. The swale is proposed along the western boundary of the park to convey exceedance flows from the south to the Whitestown Stream, shown in Figure 4-1. This swale will replace the existing informal and irregular shallow channel. It has been sized to convey 3.8 m^3/s to ensure no flooding in the 1 in 100-year event should construction of the interception trench to the south be delayed or not proceed. It will also aim to convey flows up to the 1 in 1000-year event once the interception trench is in place. Runoff from the park may be directed towards the swale, although given the nature of the proposed development, runoff is expected to be minimal. The proposed swale will vary along its length to give a more natural appearance, see Figure 4-2 for typical cross sections. Check dams or steps in the swale will slow the flow of water and einforced grass and planting at the outfall will prevent erosion.

Table 1: Estimated Greenfield Runoff Rates

Scenario	Estimated Greenfield Runoff Rate from Tallaght Hills
1 in 30-year event	3.1 m^3/s
1 in 100-year event	3.8 m^3/s
1 in 1000-year event	4.9 m^3/s (Estimated)

Figure 4-1: Proposed swale along western boundary.

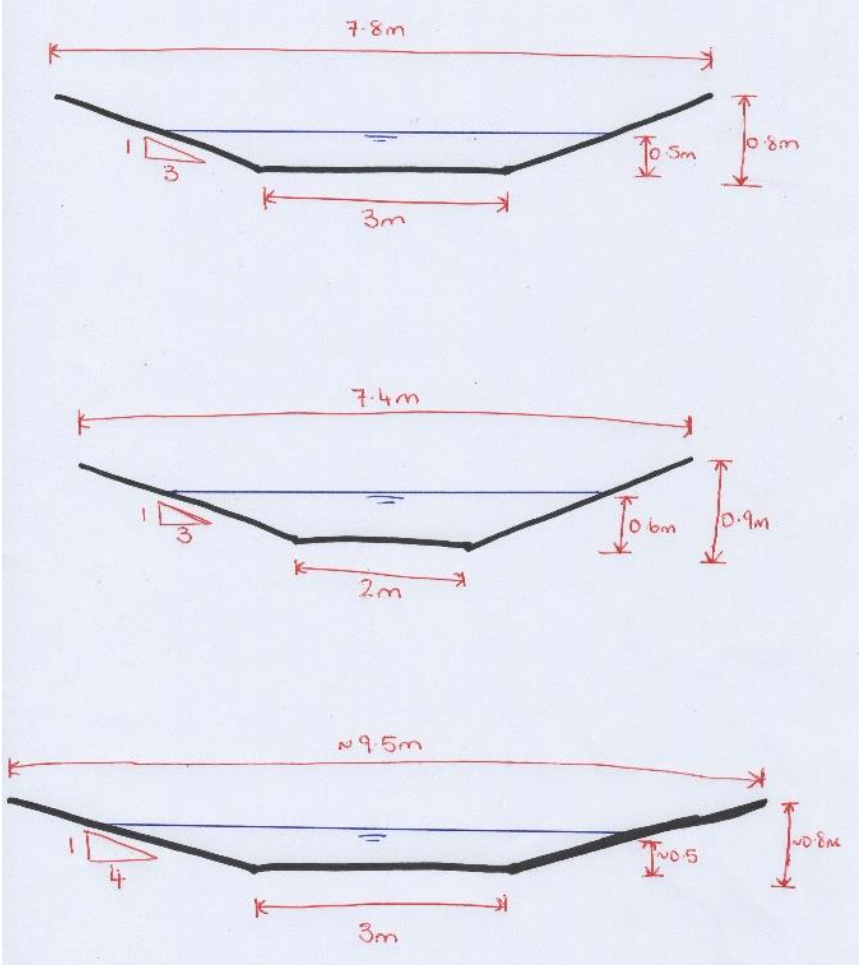


Figure 4-2: Proposed swale cross sections

4.3 Access

Access to the park is provided from all sides (refer to Figure 2 1). One access road - Whitestown Way lies in Flood Zone B and at moderate risk of flooding, but the access to the site can be provided during a flood event from other sides.

4.3.1 Climate Change

As the site is located in Flood Zone C, it is not considered to be at risk of fluvial flooding following the impact of climate change.

5 Conclusion

JBA Consulting has undertaken a Flood Risk Assessment for the proposed site development of Killinarden Park in Tallaght, Dublin. The site comprises a manmade greenfield area and covers an area c. 40.8Ha. Review of the available sources of flooding indicates there are no instances of historic flooding on site but the surface runoff from the site resulted in flooding the housing estates to the west of the site (Knockmore).

Review of the Dodder CFRAM fluvial flood maps confirm that the majority of the site is located in Flood Zone C and is considered to be low risk of inundation from fluvial flooding. A localised area of the site along the north boundary - Whitestown Way is located in Flood Zone B, however the flow attenuates to the Whitestone Stream and flows away from the site.

Regarding the surface water management for the proposed development, an interception trench has been proposed as part of a separate development to the south. This trench will intercept and attenuate flows from the Tallaght Hills up to the 1 in 30-year event. A proposed swale will replace the existing informal channel along the western boundary of the site. This will convey exceedance flows, above the 1 in 30-year storm, from the south towards the Whitestown Stream. Any runoff from the park can be directed towards the swale also but because the proposed impermeable area within the park development is minimal runoff should also be minimal and infiltration trenches alongside the paths should suffice (tbc by infiltration tests at a later date).

In summary, all development onsite is located in Flood Zone C and the proposed park development is appropriate. The Flood Risk Assessment was undertaken in accordance with 'The Planning System and Flood Risk Management' guidelines and is in agreement with the core principles contained within.

Appendices

A Appendix - Understanding Flood Risk

Flood Risk is generally accepted to be a combination of the likelihood (or probability) of flooding and the potential consequences arising. Flood Risk can be expressed in terms of the following relationship:

Flood Risk = Probability of Flooding x Consequences of Flooding

A.1 Probability of Flooding

The likelihood or probability of a flood event (whether tidal or fluvial) is classified by its Annual Exceedance Probability (AEP) or return period years, a 1% AEP flood 1 in 100 chance of occurring in any given year. In this report, flood frequency will primarily be expressed in terms of AEP, which is the inverse of the return period, as shown in the table below and explained above. This can helpful when presenting results to members of the public who may associate the concept of return period with a regular occurrence rather than an average recurrence interval and is the terminology which will be used throughout this report.

Table: Conversion between return periods and annual exceedance probabilities

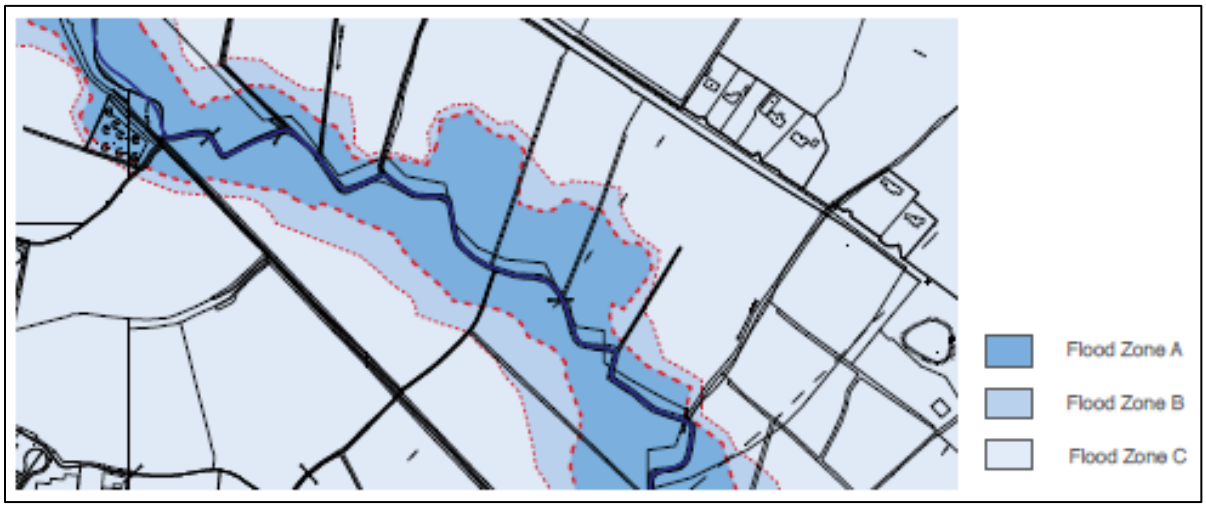
Return period (years)	Annual exceedance probability (%)
2	50
10	10
50	2
100	1
200	0.5
1000	0.1

A.2 Flood Zones

Flood Zones are geographical areas illustrating the probability of flooding. For the purpose of the Planning Guidelines, there are 3 types of levels of flood zones, A, B and C.

Zone	Description
Flood Zone A	Where the probability of flooding is highest, greater than 1% (1 in 100) from river flooding or 0.5% (1 in 200) for coastal/ tidal Flooding
Flood Zone B	Moderate probability of flooding, between 1% and 0.1% from rivers and between 0.5% and 0.1% from coastal/ tidal.
Flood Zone C	Lowest probability of flooding, les than 0.1% from both rivers and coastal/ tidal.

It is important to note that the definition of the flood zones is based on an undefended scenario and does not take into account the presence of flood protection structures such as flood walls or embankments. This is to allow for the fact that there is a residual risk of flooding behind the defences will be maintained in perpetuity.



A.3 Consequences of Flooding

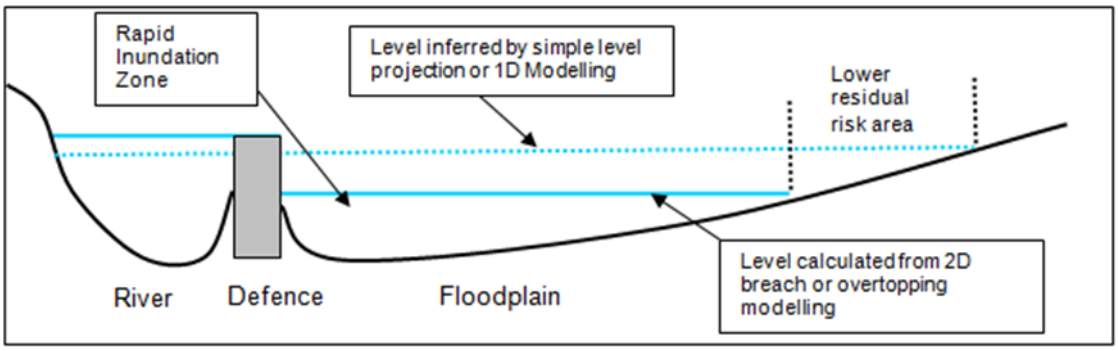
Consequences of flooding depend on the Hazards caused by flooding (depth of water, speed of flow. Rate of onset, duration, wave-action effects, water quality) and the vulnerability of receptors (type of development, nature, e.g. age-structure of the population, presence and reliability of mitigation measures etc.)

The 'Planning System and Flood Risk Management' provides three vulnerability categories, based on type of development, nature, which are detailed in Table X of the Guidelines, and are summarised as:

- **Highly vulnerable**, including residential properties, essential infrastructure and emergency service facilities
- **Less vulnerable**, such as retail and commercial and local transport infrastructure, such as changing rooms.
- **Water compatible**, including open space, outdoor recreation and associated essential infrastructure, such as changing rooms.

A.4 Residual Risk

The presence of flood defences, by their very nature, hinder the movement of flood water across the floodplain and prevent flooding unless river levels rise above the defence crest level or a breach occurs. This known as residual risk:



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