



Leixlip WTP

Site-Specific Flood Risk Assessment Report

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1. Introduction

Ryan Hanley has been commissioned by Glan Aqua, on behalf of Irish Water, to undertake a Site-Specific Flood Risk Assessment (FRA) for the proposed upgrades at the Leixlip Water Treatment Plant (WTP), Co. Dublin operated by Fingal County Council under the Service Level Agreement.

The WTP is located beside the M4 and the northern site boundary is running adjacent to R148 Leixlip Road in south County Dublin.

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 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 in Figure 2-1 and Table 2-1.

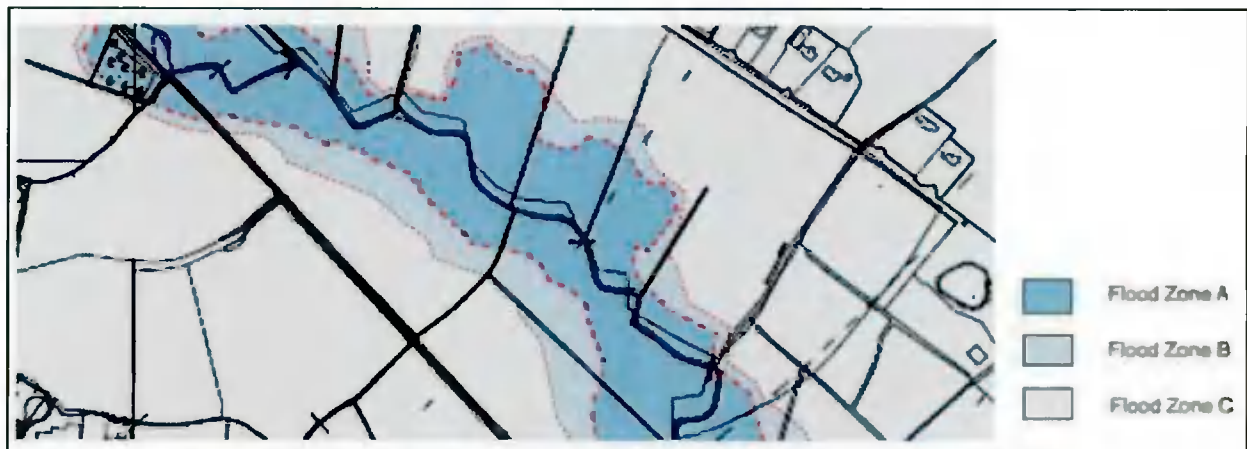


Figure 2-1: Indicative Flood Zones (OPW & DoEHLG, 2009)

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: Flood Zoning Definitions

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. Figure 2-2 characterises different land use types and their vulnerabilities.


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
Less vulnerable development	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
	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
Water-compatible development	Local transport infrastructure
	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	

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

The probability and vulnerability of flooding informs the requirement for the application of a Justification Test. The decision matrix, illustrated in Figure 2.3 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 2-3: 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 2-4 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 2-4: 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. Site Background

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

3.1 Site Description and Proposed Development

The site of the Leixlip WTP is located outside Leixlip village located on the border of Kildare and Dublin. The WTP lies South of the village adjacent to the river Liffey and it is directly accessible by the R148 road.

The site covers an area of 21.30 hectares and the coordinates of the site entrance are (53°21'45.43"N 6°29'10.88"W).



Figure 3-1: Site Location Map for the proposed development (Copyright: Bing Maps)

Ground levels in the vicinity of the proposed development are ranging from 50mOD to 30mOD with a direction SE-NW.

The proposed development includes the following:

- 1) Demolition of existing Workshop and (defunct) Activated Carbon Building adjacent the 'old' / northern Treatment Plant Building;
- 2) Construction of a Sulphuric Acid Storage and Dosing Facility Building (single storey up to approximately 8.7 metres in height) adjacent the 'new' / southern Treatment Plant Building;
- 3) Construction of a Lime Storage & Dosing Facility Building (single storey up to approximately 11 metres in height) adjoining the 'old' / northern Treatment Plant Building, associated external storage silos (2 no.) with external staircase (up to approximately 12.3 metres in height) partially enveloped with a perforated metal architectural screen, and ancillary plant and equipment;
- 4) Reconfiguration and repurposing for use as a De-Alkalisation Plant of existing (disused) High-Lift Pump Hall within the 'old' / northern Treatment Plant Building;

- 5) The construction of a new ancillary Workshop Building (single storey up to approximately 4.5 metres in height) to the rear / south of the 'old' / northern Treatment Plant Building;
- 6) Temporary and enabling works to facilitate construction and continued / uninterrupted operation of the Treatment Plant site;
- 7) Associated network of underground pipelines / connections, and redirection of existing where necessary, throughout the site; and,
- 8) Provision of additional car parking (to the rear / south of the 'old' / northern Treatment Plant Building), modification and extension of existing drainage, utility and services infrastructure and connections to serve and facilitate new and reconfigured buildings, and all other associated and ancillary development and works above and below ground level.

Figure 3-2 visualises the layout of the proposed development.

The Floor Level for the proposed de-alkalisation plant and the lime silo building are set at +35.90mOD and the Floor Level for the proposed dosing lines building at the south of the site is set at 38.80 mOD.

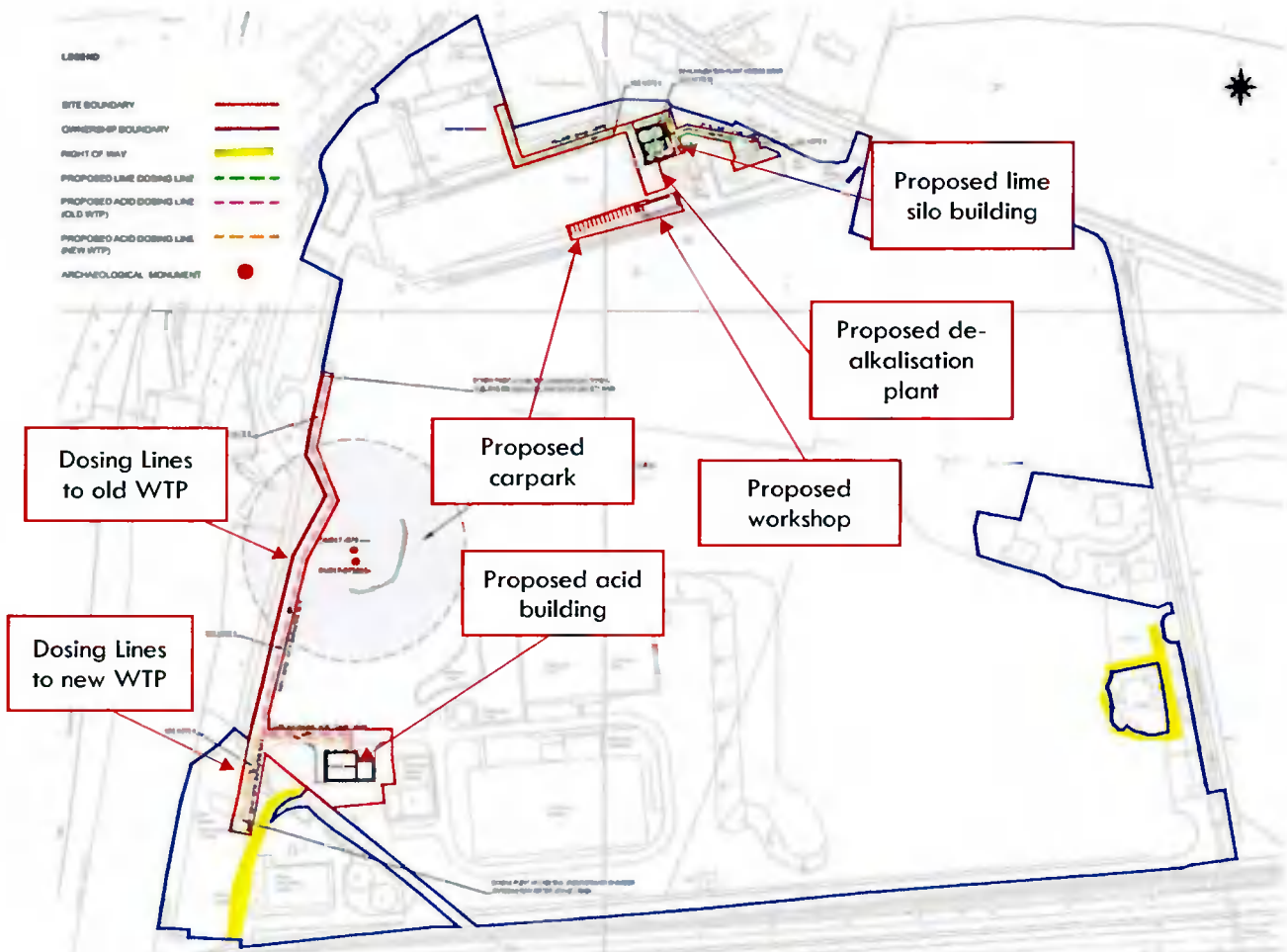


Figure 3-2: Layout plan view for the proposed WTP

3.2 Site Hydrology

The proposed site is located within the Liffey catchment which is situated in Liffey CFRAM catchment. The standard annual average rainfall (SAAR) for the site is reported at 978mm/ year (FSU, OPW). The proposed site is situated on Dark limestone & shale.

The proposed site is located south of the confluence where the Rye Water River and Orantown River discharge to the River Liffey.

Figure 3-3 shows the river network in the vicinity of the proposed development.



Figure 3-3: River Network map

3.3 Initial Flood Risk Assessment

The OPW floodmaps.ie website provides information relating to historic flooding from the River Liffey and has been consulted along with information from OSI mapping and internet searches. The following sections review historic flooding and summarise current flood risk assessment and management studies on the river.

3.3.1 Historic Flood Risk

A review of available historic flood information was undertaken for the Leixlip area including a review of the OPW database (www.floodinfo.ie). There are three reported flooding events on November 1965, November 1987 and February 1986 in relation to the River Liffey. These flooding events have no impact in the site of interest (Figure 3-4).

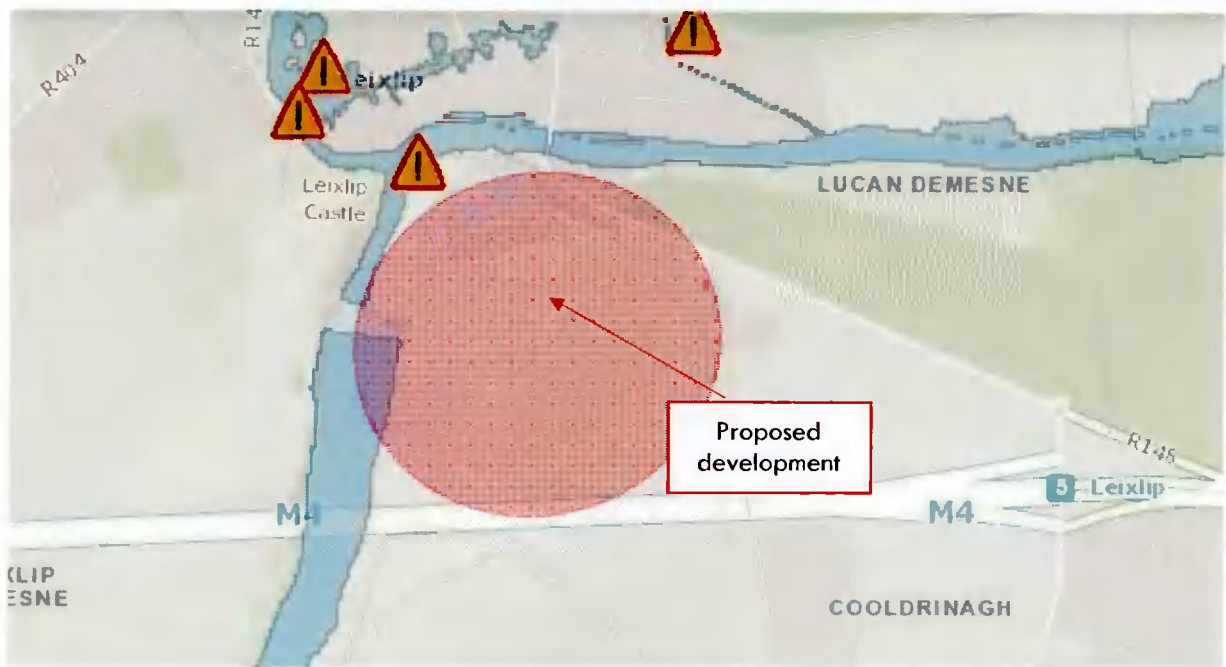


Figure 3-4: Past Flood Events

3.3.2 CFRAM OPW study

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 3-5 below and highlights that the site is clearly outside the extent of the 1:1000 flood extent.

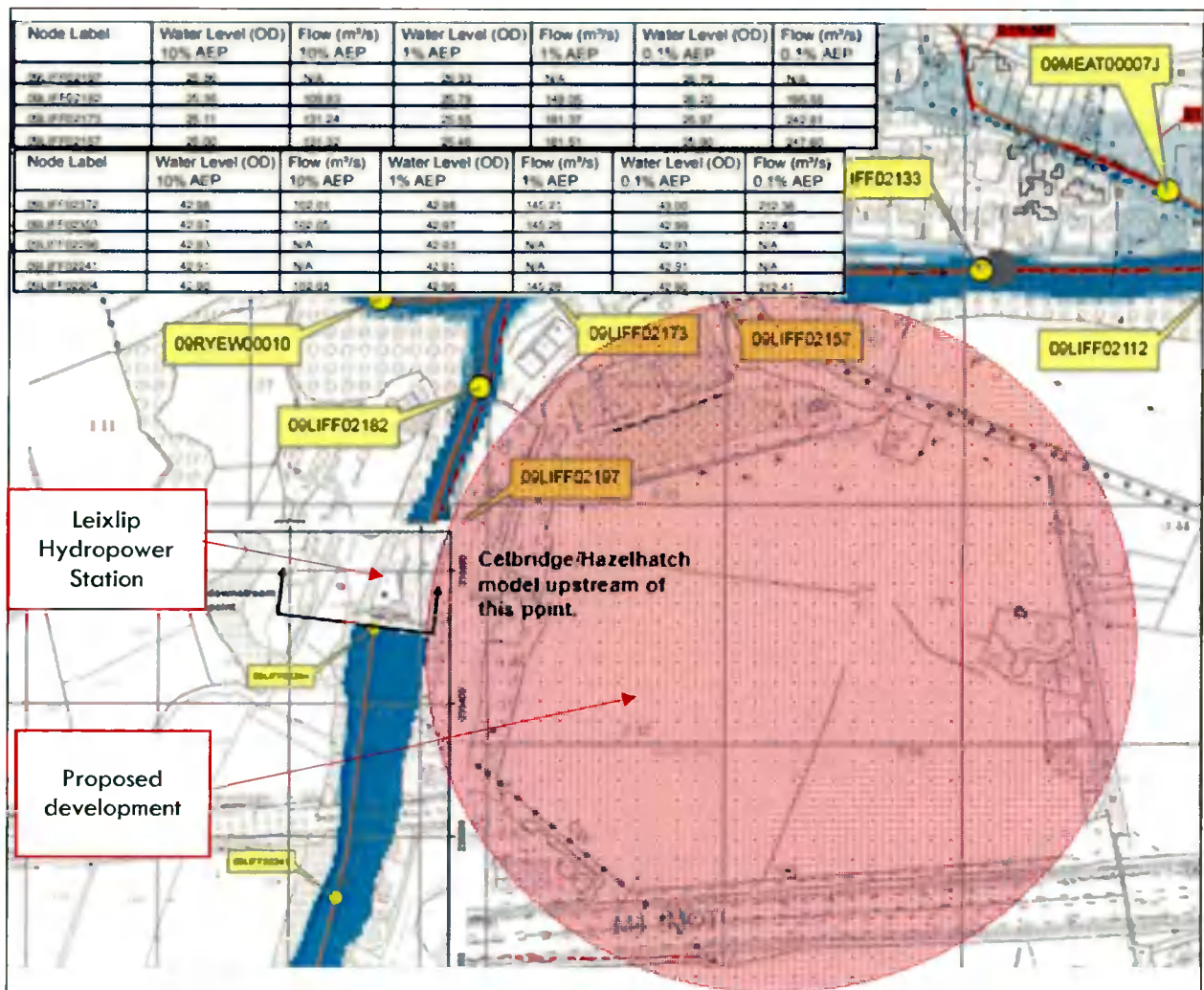


Figure 3-5: CFRAM Flood Risk Assessment Mapping (Copyright: OPW)

The flood levels range from 26.79 mOD (Southwest site-09LFF02197 node) to 25.90 mOD (Northeast site-09LFF02157 node). The Leixlip Hydropower Station is located west of the development site and a reservoir extends upstream.

The proposed dosing lines are located in the Flood Zone C as the estimated flood levels (0.1% AEP) is 42.91 mOD (Node 09LFF02241) and the ground surface levels are circa 48 mOD and, thus, well elevated above the 1 in1000 year flooding event.

The flood extent mapping above indicates that the proposed development is located outside the 1 in 1000 year (0.1% Annual Exceedance Probability [AEP]) flood extent and therefore the site is located in the **Flood Zone C**.

3.4 Summary

The initial stage of a Flood Risk Assessment requires the identification and consideration of probable sources of flooding.

3.4.1 Fluvial Flood Extent

The OPW (CFRAM) has provided a detailed assessment of flood extent from the River Liffey to the north east of the site and has resulted in confirmation that the proposed development is situated to the **Flood Zone C**.

3.4.2 Pluvial Flood Extent

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 (Figure 3-5) suggests that the probability of pluvial flooding at the site itself is low.



Figure 3-6: Draft OPW Preliminary Pluvial Flood Risk Assessment Mapping (Copyright: OPW)

3.4.3 Groundwater and tidal flooding

The groundwater and tidal flooding for the site is remote given the lack of past groundwater past flooding records and the distance from the coast.

4. Flood Risk Assessment and Management

This section of the report will confirm the land use vulnerability of the proposed development and will provide for a full appraisal of flood risk to the site that includes for effective management and mitigation measures.

4.2.1 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' (See Figure 2-2). The proposed site is clearly in Flood Zone C (low flood risk) and therefore appropriately located.

4.2.2 Mitigation Measures

4.2.2.1 Fluvial Mitigation

As outlined above the fluvial risk is extremely low in the development since there is no significant fluvial risk in the development site and therefore fluvial mitigation measures are not required. The proposed buildings and dosing lines are well elevated above the 1:1000 Flood Water Levels.

4.2.2.2 Surface Water Management

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

- Appropriate surface water drainage (gullies, downpipes), shall be provided at the site. Runoff from the works will flow to the existing drainage system
- External chemical spillages will be captured and directed to the existing sludge holding tanks
- All electrical equipment (pumps, MCC panels, etc) will be installed on 200mm concrete plinths.

4.2.2.3 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 adjacent River Liffey 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 in the River Liffey.
- All excavations and dosing line trenches 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 will be permitted to discharge directly to river Liffey.
- 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.
- The Contractor's compound shall be located in Flood Zone C.

4.3 Summary

The proposed site is located adjacent to the River Liffey. The proposed development, including buildings and associated dosing lines, have been assessed as being in Flood Zone C based on the CFRAM OPW study.

The potential for surface water flooding is extremely low as the proposed development will not be impacted by the pluvial flow regime significantly.

The proposed development will not increase flood risk on adjacent lands.

5. Conclusion

The purpose of this FRA report was to identify flood risk associated with the Leixlip WTP upgrades comprising the construction of buildings, including laying of associated dosing lines and recommend mitigation measures if required.

The site is located in Flood Zone C – at low risk of fluvial flooding and is above the potential fluvial flood level of the River Liffey as confirmed by CFRAM maps.

Although the pluvial flooding risk is relatively low, proper measures are set out for the surface water management during the life and the construction stage.

For the reasons stated above, the proposed site 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.