Waterman Moylan
Engineering Consultants




Flood Risk Assessment

Clane Library, Clane, Co. Kildare

October 2022

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This document has been prepared and checked in accordance with
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Comments

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Contents

Figures

Tables

1. Introduction

This Flood Risk Assessment has been prepared by Waterman Moylan and commissioned by Kildare County Council in support of a Part 8 planning application which proposes the refurbishment and change of use of existing retail and creche Units 8 + 9 The Village Centre, Clane, to a Library with Open Library Service.

This Flood Risk Assessment has been carried out in accordance with the *DEHLG/OPW Guidelines on the Planning Process and Flood Risk Management* published in November 2009. This assessment identifies the risk of flooding at the site from various sources and sets out possible mitigation measures against the potential risks of flooding. Sources of possible flooding include coastal, fluvial, pluvial (direct heavy rain), groundwater and human/mechanical errors. This report provides an assessment of the subject site for flood risk purposes only.

1.1 Site Description

The proposed library site is located at Clane, Co. Kildare, at the Village Centre, Main Street, as shown in *Figure 1* below.

The site was formerly used for retail and as a creche. The proposed library site is 451 square metres in area. The site is bounded by residential units to the North and East, commercial units and a church to the west, church car park and a field to the South.

The site falls from west to east. The existing levels range from 69.5 m – 68m.

The existing commercial unit on site is level at 68.14m.

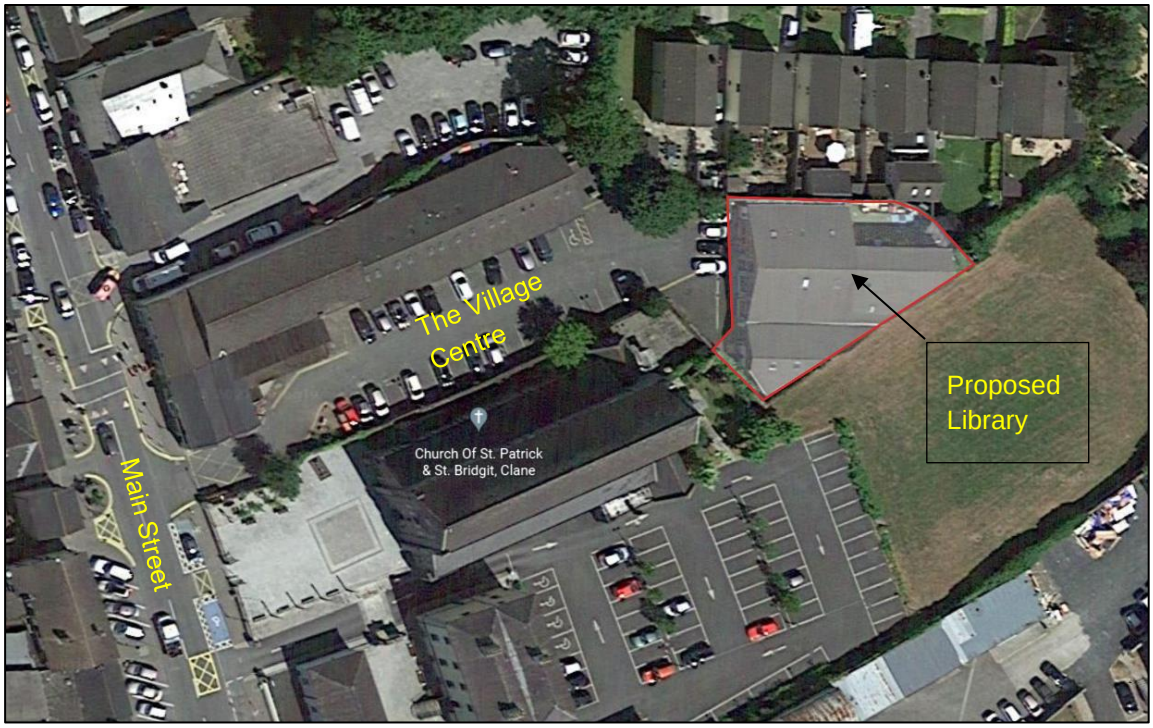

Figure 1 | *Site Location (Source: Google Earth)*

The development will be designed to include associated site works, boundary treatments, drainage, and service connections.

1.2 Background to the Report

This Flood Risk Assessment report follows the guidelines set out in the *DEHLG/OPW Guidelines on the Planning Process and Flood Risk Management* published in November 2009. The components to be considered in the identification and assessment of flood risk are as per Table A1 of the above guidelines:

- Tidal – flooding from high sea levels
- Fluvial – flooding from water courses
- Pluvial – flooding from rainfall / surface water
- Groundwater – flooding from springs / raised groundwater
- Human/mechanical error – flooding due to human or mechanical error

Each component will be investigated from a Source, Pathway and Receptor perspective, followed by an assessment of the likelihood of a flood occurring and the possible consequences.

1.2.1 Assessing Likelihood

The likelihood of flooding falls into three categories of low, moderate and high, which are described in the OPW Guidelines as follows:

Flood Risk Components	**Likelihood: % chance of occurring in a year**		
	Low	***Moderate***	***High***
Tidal	*Probability < 0.1%*	*0.5% > Probability > 0.1%*	*Probability > 0.5%*
Fluvial	*Probability < 0.1%*	*1% > Probability > 0.1%*	*Probability > 1%*
Pluvial	*Probability < 0.1%*	*1% > Probability > 0.1%*	*Probability > 1%*

Table 1 | *From Table A1 of "DEHLG/OPW Guidelines on the Planning Process and Flood Management"*

For groundwater and human/mechanical error, the limits of probability are not defined and therefore professional judgment is used. However, the likelihood of flooding is still categorized as low, moderate and high for these components.

From consideration of the likelihoods and the possible consequences a risk is evaluated. Should such a risk exist, mitigation measures will be explored, and the residual risks assessed.

1.2.2 Assessing Consequence

There is not a defined method used to quantify a value for the consequences of a flooding event. Therefore, in order to determine a value for the consequences of a flooding event, the elements likely to be adversely affected by such flooding will be assessed, with the likely damage being stated, and professional judgement will be used in order to determine a value for consequences. Consequences will also be categorized as low, moderate, and high.

1.2.3 Assessing Risk

Based on the determined 'likelihood' and 'consequences' values of a flood event, the following 3x3 Risk Matrix will then be referenced to determine the overall risk of a flood event.

		Consequences		
		Low	***Moderate***	***High***
Likelihood	**Low**	*Extremely Low Risk*	*Low Risk*	*Moderate Risk*
	Moderate	*Low Risk*	*Moderate Risk*	*High Risk*
	High	*Moderate Risk*	*High Risk*	*Extremely High Risk*

Table 2 | *3x3 Risk Matrix*

2. Tidal

2.1 Source

Tidal flooding occurs when normally dry, low-lying land is flooded by seawater. The extent of tidal flooding is a function of the elevation inland flood waters penetrate, which is controlled by the topography of the coastal land exposed to flooding.

2.2 Pathway

The site is over 30km west of the nearest coastline, at Dublin Bay. The Dublin Coastal Protection Project indicates that the 2002 high tide event reached 2.95m OD Malin. The lowest existing ground level on site is approx. 68m, well above the historic high tide event.

High probability flood events, as shown in the above map, are defined as having approximately a 1-in-10 chance of occurring or being exceeded in any given year (10% Annual Exceedance Probability), medium probability flood events are defined as having an AEP of 0.5% (1-in-200 year storm), while low probability events are defined having an AEP of 0.1% (1-in-1,000 year storm).

Given that the site is located over 30 kilometres inland from the Irish Sea, that there is at least a 66m level difference between the proposed building and the high tide and given that the site is outside of the 1-in-1,000 year flood plain, it is evident that a pathway does not exist between the source and the receptor. A risk from tidal flooding is therefore extremely low and no flood mitigation measures need to be implemented in this regard.

3. Fluvial

3.1 Source

Fluvial flooding occurs when a river / water course's flow exceeds its capacity, typically following excessive rainfall, though it can also result from other causes such as heavy snow melt and ice jams.

3.2 Pathway

The subject site is located within the catchment of the River Liffey.

The Eastern CFRAM (Flood Risk Assessment and Management Study) maps, available on the OPW's National Flood Information Portal (floodinfo.ie) and extracted below, shows that none of the subject site falls within the 0.1% AEP (1-in-1,000 year) flood plain.

Further to liaisons with KCC water services division, it is considered that the 0.1% AEP present day scenario assessment is a suitable gauge to assess the fluvial flood risk of the subject site, and this worst-case scenario takes account of future climate change.

The nearest node point, reference number: 09COTT00039J, located on a tributary of the River Liffey, will have a 1-in-1,000 year flood event water height of 66.25m, almost 2m below the lowest height of 68m on the subject lands.

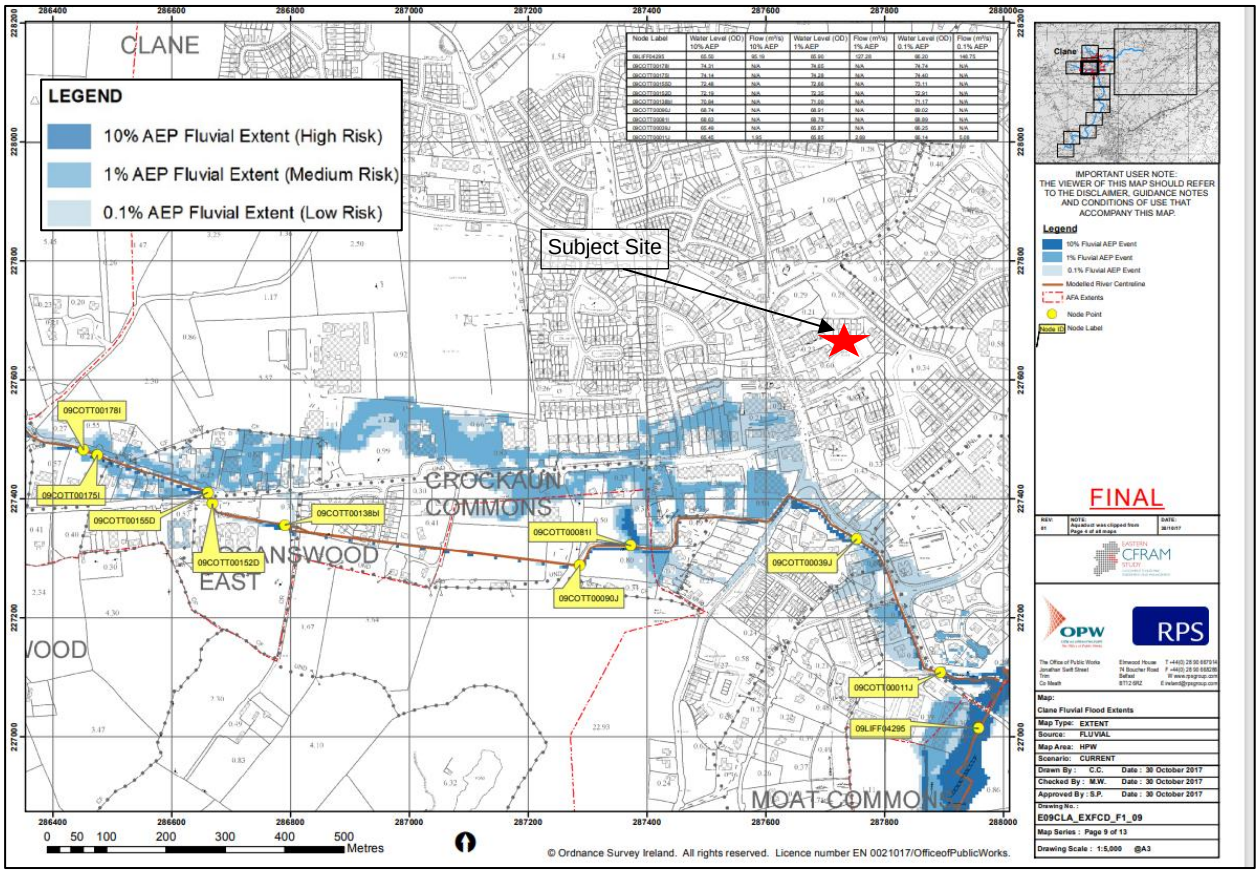

Figure 2 *| Clane CFRAM Fluvial Flood Extents Map E09CLA_exfcd_F1_09*

3.3 Likelihood

Given that the site is outside of the 1-in-1,000 year flood plain, the likelihood of fluvial flooding is extremely low. Conservatively, allowing for an expansion of the 1-in-1000 flood plain area owing to climate change, the site could conceivably be within the 1 in 1000 year flood plain in the future, therefore, conservatively, the likelihood of flood of the subject site could be considered as low in this scenario.

3.4 Consequence

The consequence of fluvial flooding would be some minor inundation to roads and buildings. Therefore, the consequences of fluvial flooding occurring at the proposed development is considered high.

3.5 Risk

There is a low to moderate risk of fluvial flooding as the likelihood is extremely low, and the consequence is high.

3.6 Flood Risk Management

The proposed development has designed finished floor levels generally over 200mm above the local road network to minimise the risk of flooding from overland flows.

To minimise the risk of downstream flooding, surfacing to the front of the proposed library is proposed to be permeable, replacing the existing full hardstanding. The surface water SuDS features have been designed to cater for roof run off, minimising the risk of downstream flooding.

An enhanced maintenance regime shall be implemented, as detailed further in section 4.

3.7 Residual Risk

The residual risk of fluvial flooding is considered as low.

4. Pluvial

4.1 Source

Pluvial flooding occurs when heavy rainfall creates a flood event independent of an overflowing water body. Pluvial flooding can happen in any urban area, including higher elevation areas that lie above coastal and river floodplains.

4.2 Pathway & Receptors

During periods of extreme prolonged rainfall, pluvial flooding may occur through the following pathways:

	Pathway	**Receptor**
1	Surcharging of the proposed internal drainage systems during heavy rain events leading to internal flooding	Proposed development – properties and roads
2	Surcharging from the existing surrounding drainage system leading to flooding within the subject site by surcharging surface water pipes	Proposed development – properties and roads
3	Surface water discharging from the subject site to the existing drainage network leading to downstream flooding	Downstream properties and roads
4	Overland flooding from surrounding areas flowing onto the subject site	Proposed development – properties and roads
5	Overland flooding from the subject site flowing onto surrounding areas	Downstream properties and roads

Table 3 | *Pathways and Receptors*

4.3 Likelihood

The likelihood of each of the 5 pathway types are addressed individually as follows:

4.3.1 Surcharging of the proposed on-site drainage systems:

The proposed on-site surface water drainage sewers have been designed to surcharge during rainfall events with a return period in excess of five years. Therefore, the likelihood surcharging of the on-site drainage system is considered high.

4.3.2 Surcharging from the existing surrounding drainage system:

The OPW's on-line portal was again consulted to ascertain the details of any local historic flood events. *Figure 3* overleaf, shows that there is no record of a previous flood event at the subject site, with the nearest historic flood (Flood ID-11181) event occurring approx. 0.5km away to the east.

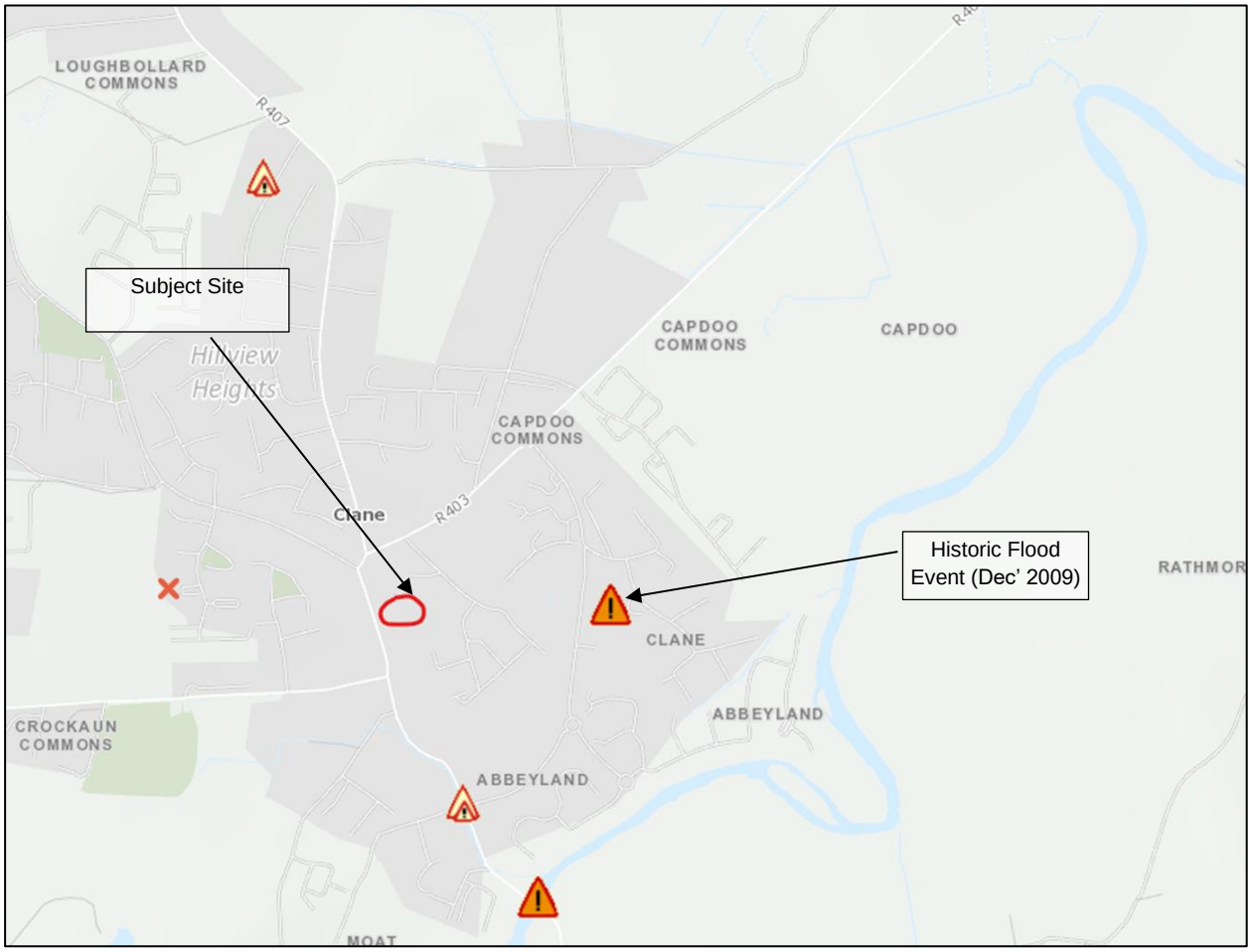

Figure 3 | *Local Flood Event History Extracted from OPW's National Flood Hazard Maps*

With no history of flooding in the area due to surcharging, the likelihood of such flooding occurring could considered low, however, given that the site is located at a low point in the road network, with drainage gullies fronting the proposed library building collecting from "The Village Centre" entrance road, if the gullies fronting the proposed library site were to block, the likelihood of flood can be considered high.

4.3.3 Surface water discharge from the subject site:

There is no net increase in hard standing area because of the proposed development, there is not proposed to be an increased likelihood of surface water discharge from the site leading to downstream flooding. The library site itself is proposed to implement a range of nature-based SuDS to slow down and cater for surface water from the subject library site, as detailed in the accompanying engineering assessment report. As such, the likelihood of excess surface water discharge can be considered low.

4.3.4 Overland flooding from surrounding areas:

With no recorded flood events in the immediate area that could have an impact on the subject site, as per the OPW records referred to above, it is considered that there is a low likelihood of flooding from surrounding areas, however, given that the library site is located at a low point in the road network, with drainage gullies fronting the proposed library building collecting from "The Village Centre" entrance road, if the gullies fronting the proposed library site were to block, the likelihood of flood to the road and surface water network can be considered high.

4.3.5 Overland flooding from the subject site:

There is not proposed to be an increase in hard standing area because of the proposed library site development, therefore there it is not anticipated there will be any increase in the likelihood of overland flooding from the site leading to downstream flooding. As such, the likelihood can be considered low.

4.4 Consequence

Surface water flooding would result in damage to roads and landscaped areas and could impact the ground floor levels of building. The consequences of pluvial flooding are considered high.

4.5 Risk

The risk of each of the 5 pathway types is addressed individually as follows:

4.5.1 Surcharging of the proposed on-site drainage systems:

With a high likelihood and high consequence of flooding the site from surcharging the on-site drainage system, the resultant risk is extremely high.

4.5.2 Surcharging from the existing surrounding drainage system:

With a high likelihood and high consequence of flooding the site from the existing surface water network, the resultant risk is extremely high.

4.5.3 Surface water discharge from the subject site:

With a low likelihood and high consequence of surface water discharge from the subject site, the resultant risk is moderate.

4.5.4 Overland flooding from surrounding areas:

With a high likelihood and high consequence of overland flooding from the surrounding areas, the resultant risk is extremely high.

4.5.5 Overland flooding from the subject site:

With a low likelihood and high consequence of overland flooding from the subject site, the resultant risk is moderate.

4.6 Flood Risk Management

The following are flood risk management strategies proposed to minimise the risk of pluvial flooding for each risk:

4.6.1 Surcharging of the proposed on-site drainage systems:

The risk of flooding is minimised with adequate sizing of the on-site surface water network and SuDS devices. Open grassed swale and a bio-retention tree pit with low level planting will ensure that these areas act as soft scape and will significantly slow down and reduce the amount of surface water runoff from the site. Similarly, planters to take roof run-off shall be appropriately located to collect from roof downpipe. Permeable surfacing shall be supplied to the front of the proposed library site to improve the existing arrangement of full hardstanding. Overall there is a significant reduction on hardstanding area and no history of prior flooding.

These proposed source and site control devices will intercept and slow down the rate of runoff from the library site to the on-site drainage system, reducing the risk of surcharging.

Excess storm water from the hardstanding (library roof) is to be catered for in the bio-retention features (planters, tree pit and swale) to limit the runoff from the site and minimise the discharge rate into receiving waters, catering for a 1 in 100-year storm event network plus 20% climate change. Model of the drainage network indicates that even without any storage included, the on-site library pipe network does not flood. Requisite storage provision shall be provided in the proposed SuDS nature-based features, including the proposed tree pit, planters and swale in the rear courtyard.

The surface water drainage line fronting the proposed library site is proposed to be upgraded to 225mm in diameter from 100mm diameter in size and a soakpit installed to afford additional protection and mitigation against flood.

As a result of these proposed measures, the likelihood of surcharging of the proposed on-site drainage systems is low. The above remedial measures have been discussed in detail and agreed with KCC WSD.

4.6.2 Surcharging from the existing surrounding drainage system:

The risk to the library is mitigated by setting finished floor levels at least 190mm above the adjacent road gully level and channel line. Given the lack of opportunity for overland flood routing, due to the location of the site in low point, the surface water network fronting the library will need to be regularly maintained and where required cleaned out. A suitable and frequent maintenance regime of inspection, cleaning and repair should be incorporated into the safety file/maintenance manual for the development. The existing 100mm diameter outfall line fronting the proposed library development, which receives water from the proposed library site, as well as “The Village Centre” road and roof hardstanding shall be upgraded to 225mm diameter in size.

It is recommended that the increased diameter outfall drainage fronting the library be inspected and jet cleaned as required monthly, increasing to fortnightly during the wetter periods. Should deterioration of the drainage network fronting library be determined during the regular inspection and jetting process, repair or indeed replacement shall be required. All these proposed works shall form part of the safety file/maintenance manual for the library

Top water levels of the wider surrounding catchment modelled through various return event scenarios, indicate that a minimum 80mm freeboard between the flood volume TWL and the building FFL is always maintained, even in extreme storm events (1 in 100 year). In this regard, an area of 100m2 is proposed to be afforded fronting the library site, set at a level between 190mm (67.95m AOD) and 140mm (68.00m AOD) below the finished floor level (68.14m AOD). This plan area allowance to a depth of 60mm caters for the requisite flood volume calculated for a 1 in 100-year storm event, maintaining minimum 80mm freeboard.

Given no overland flood route exists for the site, a pathway below FFL level is similarly proposed to be afforded via the northern passageway of the library building, to afford a path for exceedance flows to enter the rear garden of the library, which is set 150mm below FFL.

Finally, it is proposed to provide a soakpit in front of the library building, as demonstrated in drainage layout drawing 21-105-P2000, affording an additional layer of protection for surface water exceedance flows.

As a result of these proposed measures, the likelihood of surcharging of the proposed on-site drainage systems still exists but flood of the subject library site is suitably mitigated against when they are implemented.

The above remedial measures have been discussed in detail and agreed with KCC WSD

4.6.3 Surface water discharge from the subject site:

Surface water discharge from the subject site is intercepted and slowed down through the use of source control devices, as described in Section 4.6.1 above, minimising the risk of pluvial flooding from the subject site.

As a result of these proposed measures, the likelihood of surcharging of the proposed on-site drainage systems is low.

4.6.4 Overland flooding from surrounding areas:

The risk from overland flooding from surrounding areas is high. Finished floor levels set above surface water flood levels, will provide protection for the proposed buildings, as described in Section 4.6.2 above. Similarly, it is recommended that the increased diameter outfall drainage fronting the library be inspected and jet cleaned as required monthly, increasing to fortnightly during the wetter periods. Should deterioration of the drainage network fronting library be determined during the regular inspection and jetting process, repair or indeed replacement shall be required. All these proposed works shall form part of the safety file/maintenance manual for the library.

As a result of these proposed measures, the likelihood of overland flooding from surrounding areas still exists but flood of the subject library site is suitably mitigated against when they are implemented.

4.6.5 Overland flooding from the subject site:

The risk of overland flooding from the subject site is minimised by providing SuDS features to intercept and slow down the rate of runoff from the site to the existing surface water sewer system, as described in Section 4.6.1 above, catering for 1 in 100-year event plus 30% climate change. Thus, even under extreme storm conditions, the surface water from the library site itself can function without causing flooding

4.7 Residual Risk

As a result of the design measures detailed above in Section 4.6, there is an overall low residual risk of flooding from each of the pluvial surface water risks.

This residual risk from surrounding area exceedance flows and surcharging of the existing networks, as noted in the above section 4.6, is mitigated by setting finished floor level (68.14m AOD) 190mm above the adjacent road gully level (67.95m AOD) and channel line. Given the lack of opportunity for overland flood routing, due to the location of the site in low point, the surface water network fronting the library will need to be regularly maintained and where required cleaned out. A suitable and frequent maintenance regime of inspection, cleaning and repair should be incorporated into the safety file/maintenance manual for the development. The existing 100mm diameter outfall line fronting the proposed library development, which receives water from the proposed library site, as well as “The Village Centre” road and roof hardstanding shall be upgraded to 225mm diameter in size fronting the library site, along with the provision of a soakpit to assist in catering for exceedance flows during extreme weather events.

It is recommended that the increased diameter outfall drainage fronting the library be inspected and jet cleaned as required monthly, increasing to fortnightly during the wetter periods. Should deterioration of the drainage network fronting library be determined during the regular inspection and jetting process, repair or indeed replacement shall be required. All these proposed works shall form part of the safety file/maintenance manual for the library. The above remedial measures have been discussed in detail and agreed with KCC WSD

5. Groundwater

5.1 Source

Groundwater flooding occurs when the water table rises above the ground surface. This typically happens during periods with prolonged rainfall which exceeds the natural underground drainage system's capacity.

5.2 Pathway

The pathway for groundwater flooding is from the ground. Note that although groundwater flooding is typically considered to be when the water table rises above the ground surface, underground services and building foundations could also be affected by high water tables that do not reach the ground surface.

5.3 Receptor

The receptors for ground water flooding would be underground services, roads and the ground floor of buildings.

5.4 Likelihood

Geological Survey Ireland (GSI) produces a wide range of datasets, including groundwater vulnerability mapping. From the GSI groundwater vulnerability map, extracted below, the site lies within an area with high groundwater vulnerability.

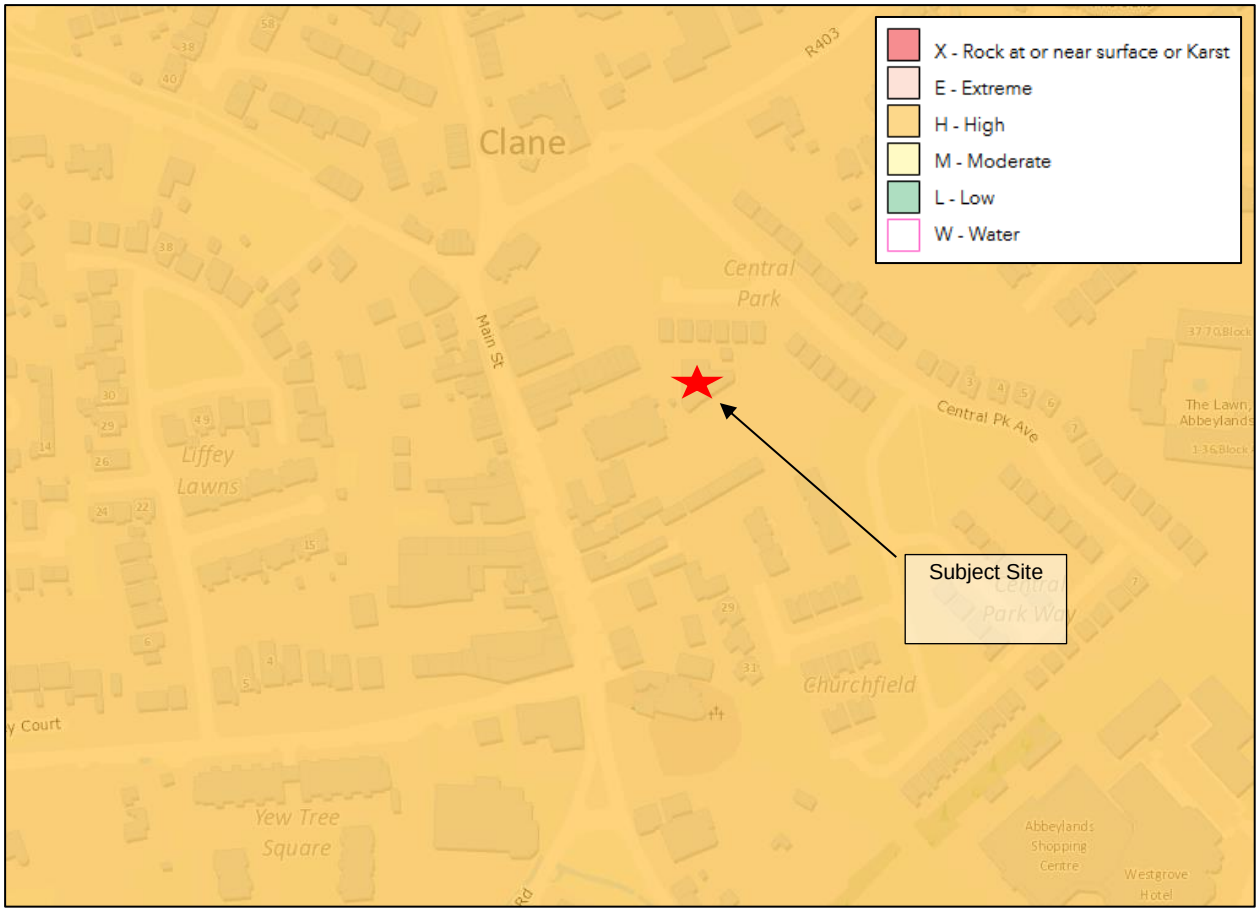

Figure 4 | *Extract of Groundwater Vulnerability Map*

With the site falling within an area with high groundwater vulnerability, and with the potential for groundwater levels to rise further, owing to future climate change, a high to extreme groundwater vulnerability should be considered for this site.

With a groundwater vulnerability at the site classified as 'High to extreme.' This classification is due to the proximity of the bedrock to the surface. At the site location itself the bedrock is not exposed. There are no karst features, wells or springs identified at the site location which could be an indication for groundwater flooding.

Review of the available geological and hydrogeological data shows groundwater vulnerability to be high to extreme; however, the presence of the subsoil deposits and a lack of karst features at the site indicate an overall low risk from groundwater flooding to the site.

5.5 Consequence

The consequence of ground water flooding would be some minor temporary seepage of ground water through the ground around the proposed buildings. Underground services could be inundated from high water tables. Therefore, the consequence of ground water flooding occurring at the proposed development is considered moderate.

5.6 Risk

With a low likelihood and moderate consequences of flooding due to groundwater, the risk is considered moderate.

5.7 Flood Risk Management

Finished floor levels have been set above the road levels, as described in Section 3.6, to ensure that any seepage of ground water onto the development does not flood into the buildings. There is no history of groundwater flood at the proposed site.

The buildings' design will incorporate suitable damp-proof membranes to protect against damp and water ingress from below ground level.

5.8 Residual Risk

There is a low residual risk of flooding from ground water. This residual risk from surrounding area groundwater, is mitigated by setting finished floor levels at least 200mm above the adjacent road gully level and channel line. Given the lack of opportunity for overland flood routing, due to the location of the site in low point, the surface water network fronting the library will need to be regularly maintained and where required cleaned out. A suitable and frequent maintenance regime of inspection, cleaning and repair should be incorporated into the safety file/maintenance manual for the development. The existing 100mm diameter outfall line fronting the proposed library development, which receives water from the proposed library site, as well as "The Village Centre" road and roof hardstanding shall be upgraded to 225mm diameter in size, and a soakpit installed to provide an additional layer of protection. Drainage to be installed per final issue construction drawings.

It is recommended that the increased diameter outfall drainage fronting the library be inspected and jet cleaned as required monthly, increasing to fortnightly during the wetter periods. Should deterioration of the drainage network fronting library be determined during the regular inspection and jetting process, repair or indeed replacement shall be required. All these proposed works shall form part of the safety file/maintenance manual for the proposed library.

6. Human/Mechanical Errors

6.1 Source

The subject site will be drained by an internal private storm water drainage system, which discharges to the existing surface water network, fronting the proposed library site.

The internal surface water network is a source of possible flooding, if it were to become blocked. Similarly, the external surface water network within “The Village Centre” and the proposed upgraded 225mm outfall line are also sources of possible flooding for the same reason.

6.2 Pathway

If the proposed drainage system blocks this could lead to possible flooding within the private and public areas.

6.3 Receptor

The receptors for flooding due to human/mechanical error would be the ground floor levels of buildings, the roads and the open landscaped areas around the site.

6.4 Likelihood

There is a high likelihood of flooding on the subject site if the surface water network were to become blocked.

6.5 Consequence

The surface water network would surcharge and overflow through manhole lids and SuDS features. It is, therefore, considered that the consequences of such flooding are high.

6.6 Risk

With a high likelihood and high consequence, there is an extremely high risk of surface water flooding should the surface water network block.

6.7 Flood Risk Management

As described in Section 3.6, finished floor levels have been designed to be above the adjacent road network, which will reduce the risk of flooding if the surface water network were to block.

Given the lack of opportunity for overland flood routing, due to the location of the site in low point, the surface water network fronting the library will need to be regularly maintained and where required cleaned out. A suitable and frequent maintenance regime of inspection, cleaning and repair should be incorporated into the safety file/maintenance manual for the development. The existing 100mm diameter outfall line fronting the proposed library development, which receives water from the proposed library site, as well as “The Village Centre” road and roof hardstanding shall be upgraded to 225mm diameter in size, and a soakpit installed to provide an additional layer of protection. Drainage to be installed per final issue construction drawings.

It is recommended that the increased diameter outfall drainage fronting the library be inspected and jet cleaned as required monthly, increasing to fortnightly during the wetter periods. Should deterioration of the drainage network fronting library be determined during the regular inspection and jetting process, repair or

indeed replacement shall be required. All these proposed works shall form part of the safety file/maintenance manual for the proposed library.

6.8 Residual Risk

As a result of the flood risk management outlined above, there is a low residual risk of overland flooding impacting the library site from human / mechanical error.

7. Conclusions and Recommendations

The subject lands have been analysed for risks from tidal and fluvial flooding from the Irish Sea and River Liffey, pluvial flooding, ground water and failures of mechanical systems. *Table 4*, below, presents the various residual flood risks involved.

Source	Pathway	Receptor	Likelihood	Consequence	Risk	Mitigation Measure	Residual Risk
Tidal	*Irish Sea*	*Proposed development*	*Extremely low*	*High*	*Extremely low*	*None*	Extremely low
Fluvial	*River Liffey*	*Proposed development*	*Extremely Low to low*	*High*	*Low to moderate*	*Setting of floor levels & freeboard, enhanced maintenance regime*	Low
Pluvial	*Private & Public Drainage Network*	*Proposed development, downstream properties, and roads*	*Ranges from high to low*	*High*	*Ranges from extremely high to moderate*	*Appropriate drainage, SuDS, setting of floor levels. & freeboard, enhanced maintenance regime*	Low
Ground Water	*Ground*	*Underground services, ground level of buildings, roads*	*Low*	*High*	*Moderate*	*Appropriate setting of floor levels, damp proof membranes, enhanced maintenance regime*	Low
Human/ Mechanical Error	*Drainage network*	*Proposed development*	*High*	*High*	*Extremely High*	*Setting of floor levels, regular inspection of SW network, enhanced maintenance regime*	Low

Table 4 | *Summary of the Flood Risks from the Various Components*

As indicated in the above table, the various sources of flooding have been reviewed, and the risk of flooding from each source has been assessed. Where necessary, mitigation measures have been proposed. As a result of the proposed mitigation measures, the overall residual risk of flooding from any source is low, with ongoing maintenance of the outfall network of critical importance. Construction of the proposed drainage and SuDs network to be in accordance with the design drawings.

UK and Ireland Office Locations