Waterman Moylan
Engineering Consultants

Flood Risk Assessment

Post Primary School at Griffeen Community College in Lucan

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Comments

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Content

1. Introduction

This Flood Risk Assessment has been prepared by Waterman Moylan on behalf of the Department of Education for the development of a new 1000 pupil post primary school. The proposed school is located to the south of Griffeen Avenue in Lucan.

2. Site Description

The subject site is approximately 2.34 hectares with an existing ground level of between 58.62m and 54.75m OD Malin. The site falls from the south to north.

Access is provided from the existing access road to the Lucan East Educate Together National School located to the west, adjacent to the site. The existing site access has levels of 54.86 m OD Malin.

The proposed road levels around the proposed school generally range from 56.19m to 57.08m OD Malin.

2.1 Proposed Development

The proposed development consists of a 1000 pupil post primary school with 4 Special Needs Units. The site is bounded by green space, existing roads and residential areas to the North, East and West and the South.

The site location can be seen in Figure 1 below;

Figure 2-1: Site Location

This report provides an assessment of the subject site for flood risk purposes only.

The total surfaced area of the proposed new school, including roads, and roofs, is approximately 1.24 Ha. The existing ground levels in this area are between 58.62 m and 54.75 m OD Malin.

The finished floor levels of the proposed school buildings will be set at 56.75 m OD Malin for the post primary school.

3. Flood Risk

3.1 Introduction

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
- Ground Water – flooding from springs / raised ground water
- 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.

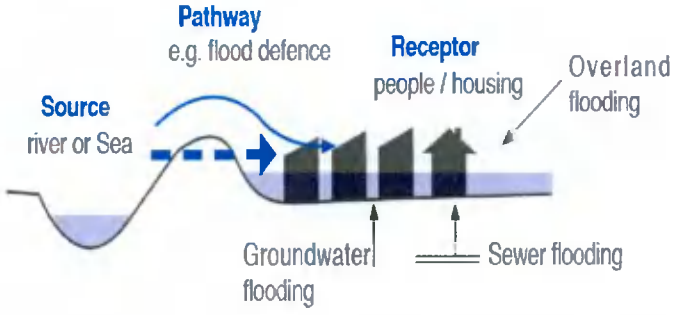


Figure 1: Source-Pathway-Receptor S-P-R Model

The ultimate aim of a flood risk assessment is to combine these components and map or describe the risks on a spatial scale, so that the consequences can then be analysed.

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

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

Likelihood	Low	Moderate	High
Tidal	Where probability < 0.1 % chance of occurring in a year	0.5 % chance of occurring in a year > probability > 0.1 % chance of occurring	Where probability > 0.5 % chance of occurring in a year

		in a year	
Fluvial	Where probability < 0.1 % chance of occurring in a year	1 % chance of occurring in a year > probability > 0.1 % chance of occurring in a year	Where probability > 1 % chance of occurring in a year
Pluvial	Where probability < 0.1 % chance of occurring in a year	1 % chance of occurring in a year > probability > 0.1 % chance of occurring in a year	Where probability > 1 % chance of occurring in a year

For ground water 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.

3.2 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.

3.3 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.

Table 2: 3x3 Risk Matrix

		CONSEQUENCES		
LIKELIHOOD		LOW	MODERATE	HIGH
	LOW	Extremely Low Risk	Low Risk	Moderate Risk
	MODERATE	Low Risk	Moderate Risk	High Risk
	HIGH	Moderate Risk	High Risk	Extremely High Risk

3.4 Sequential Test

A sequential approach to planning is a key tool in ensuring that development, particularly new development, is first and foremost directed towards land that is at low risk of flooding. Sequential approaches are already established and working effectively in other areas in the plan making and development management processes. The sequential approach described in Fig. 6 should be applied to all stages of the planning and development management process. It is of particular importance at the plan

making stage but is also applicable in the layout and design of development within a specific site at the development management stage.

Figure 6: Sequential Approach

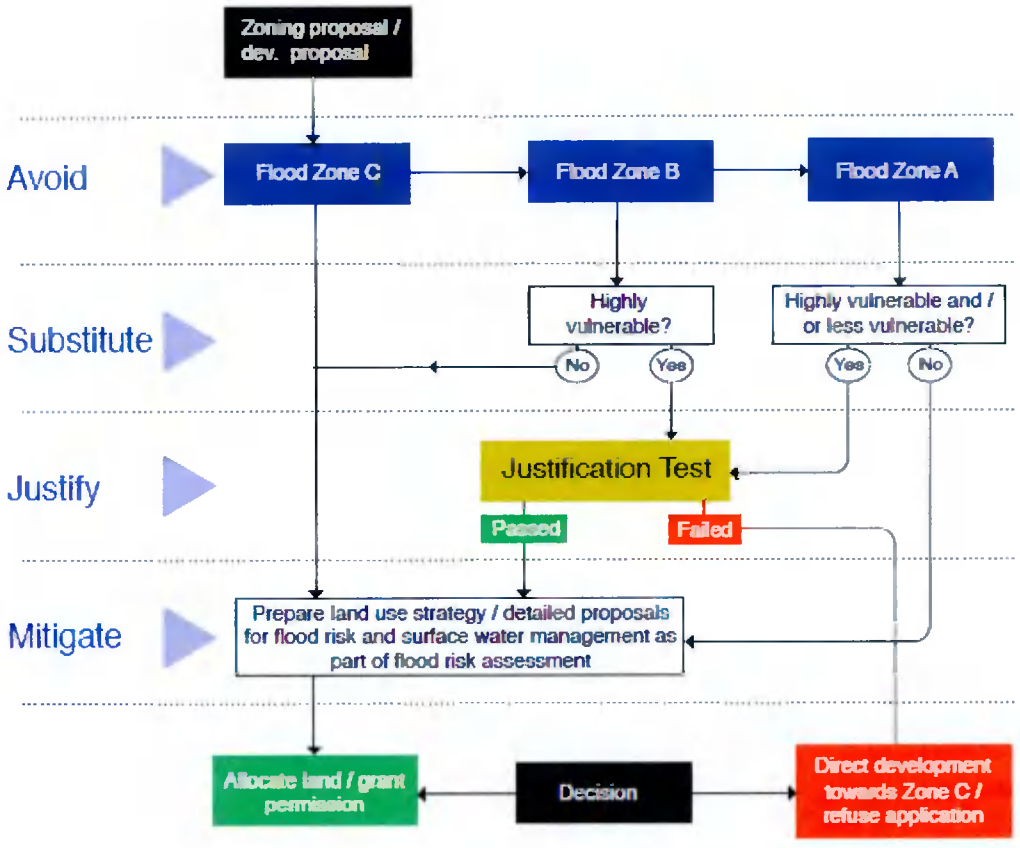


Figure 7 lists the vulnerability classes and the appropriate land uses for each type and as can be seen from the Figure 7, the proposed development is in Flood Zone C as it is at a very low risk of flooding from all sources therefore in line with Figure 6 a Justification Test is not required.

4. Tidal – Irish Sea

4.1 Sources

The subject site is located approximately 17km away from the nearest inlet of the Irish Sea. The proposed development is to be constructed with levels ranging between 54.78m and 57.08m and finished floor level of 56.75m.

Figure 4-1: Site Location in Relation to Irish Sea

The Dublin Coastal Protection Project indicated that the 2002 high tide event reached 2.95m OD Malin. The subject site is, therefore, between 51.83m and 54.13m above the highest tide recorded in the Dublin Coastal area and proposed floor level of 53.80m above.

Given that the site is located 17 kilometres inland from the Irish Sea and that there is at least a 53.80m level difference between the subject lands and the high tide it is evident that a pathway does not exist between the source and the receptor.

A risk from tidal flooding is, therefore, very low and no flood mitigation measures need to be implemented.

5. Fluvial

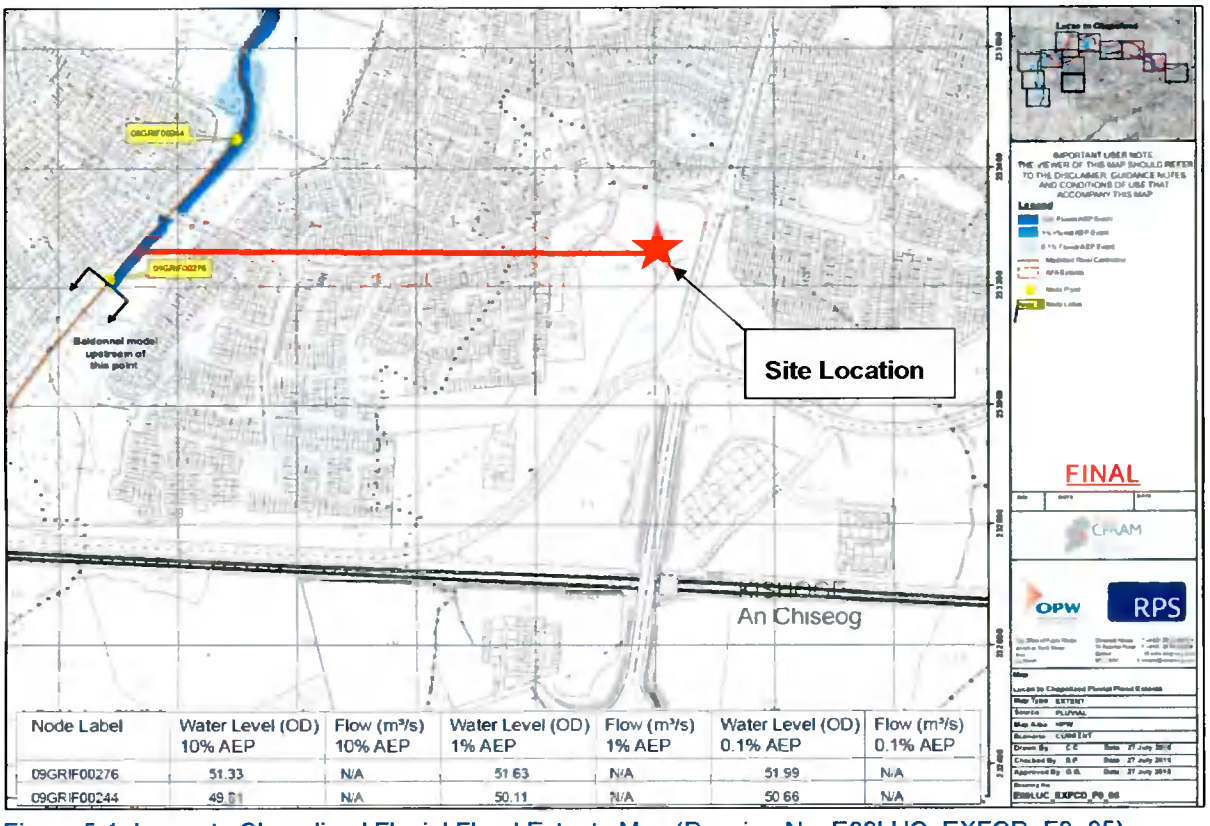
5.1 Source

The subject site is 800m east of the Lucan River.

5.2 Pathway

The proposed development is to be constructed with road levels between 54.78m and 57.08m and a finished floor level of 56.75m.

CFRAM maps have been consulted in relation to the fluvial flooding risks. The closest map to the subject site is Map E09LUC_EXFCD_F0_05 shows the fluvial flood extents of the Lucan River. The closest node to the site is node 09GRIF00276 which shows a water level of 51.99m OD for the 1 in 1000-year storm.



Node Label	Water Level (OD) 10% AEP	Flow (m³/s) 10% AEP	Water Level (OD) 1% AEP	Flow (m³/s) 1% AEP	Water Level (OD) 0.1% AEP	Flow (m³/s) 0.1% AEP
09GRIF00276	51.33	N/A	51.63	N/A	51.99	N/A
09GRIF00244	49.81	N/A	50.11	N/A	50.66	N/A

Figure 5-1: Lucan to Chapelizod Fluvial Flood Extents Map (Drawing No. E09LUC_EXFCD_F0_05)

5.3 Receptor

The receptor of any fluvial flooding is the proposed school buildings and associated roads and car parking.

5.4 Likelihood

Given that the indicative flood map indicates that no fluvial flooding will occur at the proposed site for a 1 in 100 year storm event, and as per the OPW guidelines, the likelihood of tidal flooding is therefore low.

5.5 Consequence

Should the Lucan River overspill its banks, flooding of the roads and landscaped areas around the river would occur. The school site is located 800m away from the river and c.5m above the river banks elevation. The consequence is therefore considered low.

5.6 Risk

With low likelihood and low consequence, the subsequent risk of fluvial flooding to the subject site is considered low.

5.7 Flood Risk Management

As part of the works to site, the 1 in 1000 year flood level for the Lucan River near the subject site is to be confirmed, and the school building will be c. 4.76m above this. The school building shall be built at a level above the surrounding roads and footpaths so as to create an overland flood route that minimises the chance for flooding of the proposed school building.

5.8 Residual Risk

There is a low residual risk of fluvial flooding following the appropriate design of the overland flood routing.

6. Pluvial

6.1 Source

The source of pluvial flooding is from heavy rainfall.

6.2 Pathways & 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 school building and roads
2	Surcharging from the existing surrounding drainage system leading to flooding within the subject site by surcharging surface water pipes	Proposed school building 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 school building and roads
5	Overland flooding from the subject site flowing onto surrounding areas	Downstream properties and roads

It is proposed to discharge surface water from the subject site at a restricted rate of 4.48 l/s to the existing surface water drainage network that has been designed to accommodate the proposed development.

6.3 Likelihood

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

6.3.1 Surcharging of the proposed on-site drainage system:

The proposed on-site surface water drainage sewers have been designed to accommodate flows from a 5 year return event which indicates that on average the internal system may 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.

6.3.2 Surcharging of the existing surrounding drainage system:

The existing drainage system has capacity to accommodate development on the subject site and, therefore, the likelihood of flooding is low.

6.3.3 Surface water discharge from the subject site:

Due to the increase in hard standing area as a result of the proposed development, there is an increase in likelihood of surface water discharge from the site leading to downstream flooding. The likelihood is considered moderate.

6.3.4 Overland flooding from surrounding areas:

The Office of Public Works (OPW) records for predictive and historic flood maps and benefiting land maps have been consulted with regard to recorded flood events in the vicinity of the subject site. A map showing all flood events within 2.0 kilometres of the subject site was downloaded from the OPW website and is provided below in Figure 6-1.

Figure 6-1: OPW Land Benefiting Maps and Historic Flood Maps

There are 2 No. recorded flood events within 2.0km of the subject site.

The flood event occurred in 2005 and 1994 located 2km from the subject site. These flood events were highly localised. As such, it is not considered a threat to the proposed development.

6.3.5 Overland flooding from the subject site:

Due to the increase in hard standing area as a result of the proposed development, there is an increased likelihood of overland flooding from the site leading to downstream flooding. The likelihood is considered high.

6.4 Consequence:

The consequence of surface water flooding arising from the 5 pathway types would result in moderate to high damage to roads and properties.

6.5 Risk:

6.5.1 Surcharging of the proposed on-site drainage systems

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

6.5.2 Surcharging from the existing surrounding drainage system:

With a low likelihood and moderate to high consequence of flooding the site from the existing surface water network, the resultant risk low to moderate.

6.5.3 Surface water discharging from the subject site:

With a moderate likelihood and moderate to high consequence of flooding downstream of the site due to excess discharge surface water from the site, the resultant risk is moderate to high.

6.5.4 Overland flooding from surrounding areas:

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

6.5.5 Overland flooding from the subject site:

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

6.6 Flood Risk Management:

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

6.6.1 Surcharging of the proposed on-site drainage systems:

Due to the adequate sizing of surface water network, the provision of SUDS devices and the clearance between finished floor level and surrounding roads, the residual risk is to be considered low.

6.6.2 Surcharging from the existing surrounding drainage systems:

Due to the clearance between finished floor levels and surrounding roads, the residual risk from flooding from existing surface network is considered low.

6.6.3 Surface Water discharging from the site:

Surface water discharging from the development will be limited by a hydrobrake to ensure the maximum discharge rate from the site is limited to 4.48 l/s.

6.6.4 Overland flooding from surrounding areas:

The risk from overland flooding from surrounding areas is low. Overland flood routing and raised finished floor levels will provide protection for the proposed buildings.

6.6.5 Overland flooding from the subject site:

The risk is minimised by providing overland flooding through the development with raised finished floor levels above the adjacent road network.

6.7 Residual Risk:

As a result of the design measures detailed above in Section 6.6, there is a low residual risk of flooding from each of the surface water risks. The flood risk management measures set out in Section 6.6 will minimise the risk, ensuring that any overland flooding from surface water will result in the flooding of the internal roads only.

7. Groundwater

7.1 Source

During periods with prolonged rainfall the groundwater can seep to above ground level.

7.2 Pathway

During periods with prolonged rainfall there is a possibility that the groundwater level would rise. This could result in ground water seeping to the ground surface.

7.3 Receptor

The receptors would be the buildings and roads of the proposed development.

7.4 Likelihood

There is no known history of ground water / springs seeping through the ground in this area. However, it is possible for ground water to rise and cause potential flooding on site during prolonged wet periods. The proposed roads and buildings are constructed above the existing ground level with no significant cut proposed on site.

7.5 Consequence

The consequence of ground water flooding would be some minor temporary seepage of ground water through the ground around the proposed buildings and landscaped areas.

7.6 Risk

There is a low risk of ground water flooding as the consequence is low.

7.7 Flood Risk Management

In the event of ground water flooding on site, this water can escape from the site via the overland flood routing.

7.8 Residual Risk

There is an extremely low residual risk of flooding from ground water.

8. Human / Mechanical Errors

8.1 Source

The subject lands will be drained by an internal storm water drainage system which discharges to the existing surface water drainage system via a flow control manhole. This internal surface water network is the source of possible flooding from the system if it was to block.

8.2 Pathway

If the proposed drainage system blocks this could lead to possible flooding within the development area.

8.3 Receptor

The receptors are the proposed buildings and roads.

8.4 Likelihood

There is a high possibility of flooding on the subject site if the surface water network was to block.

8.5 Consequence

There is a high risk consequence should be the surface water system blocked.

8.6 Risk

The surface water network would surcharge and overflow through gullies and manhole lids.

8.7 Flood Risk Management

As described in Section 6.6, levels on site have been designed such that in the event of the surface water system surcharging, surface water can still escape from the site by overland flood routing without entering the school building. The surface water network would need to be unblocked and maintained should a blockage occur.

8.8 Residual Risk

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

9. Conclusions and Recommendations

The subject lands have been analysed for risks from flooding from the Irish Sea, fluvial flooding, pluvial flooding, ground water and failures of mechanical systems. Through careful design and appropriate mitigation measures the risks and consequences of flooding have been mitigated across the development.

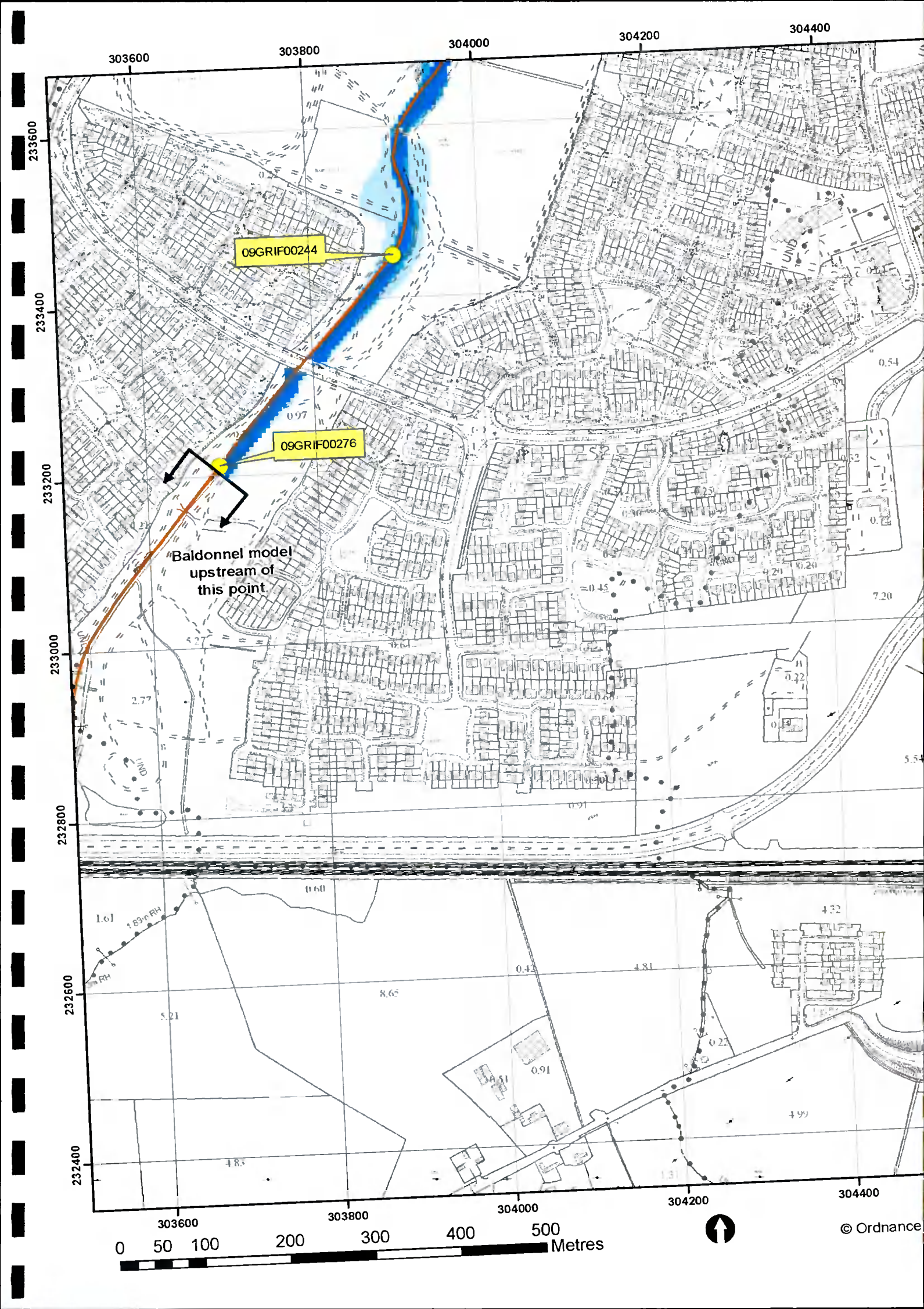
Surface water runoff from the site is limited to Greenfield runoff and does not impact on developments upstream or downstream of the subject site.

Table 3: Summary of the Flood Risks from the Various Components

Source	Pathway	Receptor	Likelihood	Consequence	Risk	Mitigation Measure	Residual Risk
Tidal	None	Proposed Development	Negligible	None	Negligible	None	**Extremely Low**
Fluvial	Site bounded by Rivers	Proposed Development	Low	Moderate. Flooding of the proposed road and buildings.	Low	Appropriate design of Overland Flood Routing	**Low**
Pluvial	Private and Public Drainage Network	Proposed Development , associated roads and landscaped areas	Low-High	Moderate. Flooding of the proposed buildings and roads	Moderate risk of moderate to severe damage to properties	Appropriate drainage design, over land flood routing and setting of floor levels	**Low**
Ground Water	Ground	Proposed Development	Low	Low. Saturation of the surrounding grounds during long rainfall periods	Low risk of minor saturation of area around the development	Appropriate drainage design, over land flood routing and setting of floor levels	**Extremely Low**
Human / Mechanical Error	Drainage network	Proposed Development	High	Moderate. Surcharging of surface water network resulting in flooding of the properties	Moderate risk of minor damage to properties	Appropriate drainage design, over land flood routing and setting of floor levels	**Low**

APPENDICES

A. Flood Maps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