



**GRAINGER PLC
BLUE STAR LAND
WATERLOOVILLE**

FLOOD RISK ASSESSMENT

AUGUST 2025



the journey is the reward

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Report Reference:	GTWVILLE_BSL_DOC_04_5
Project Code:	SL/GTBLUESTARLAND.23
Prepared by:	FA
Approved by:	RHA
Issue Date:	August 2025
Status:	FINAL

**Grainger PLC
Blue Star Land
Waterloooville
Flood Risk Assessment**

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1 Introduction

- 1.1 Mayer Brown Ltd has been commissioned by Grainger PLC to undertake a Flood Risk Assessment in support of an outline planning application for a proposed residential development at Blue Star Land (BSL), Waterloooville, PO7 7PS (nearest post code).
- 1.2 According to the Environment Agency's (EA) indicative flood map (see Appendix A) the site is located in a low risk Flood Zone 1.
- 1.3 As outlined in the NPPF, for development proposals on sites comprising one hectare or more in a Flood Zone 1, the FRA should consider i) the vulnerability of flooding from sources other than river and sea flooding, ii) the potential to increase flood risk elsewhere through the addition of hard surfaces and iii) the effect of the new development on surface water runoff.
- 1.4 This FRA considers the impact of the proposed development in addition to the common ways in which flooding can occur. The conditions currently existing in the location of the site are described, together with the methods used to identify and assess potential impacts caused by the development proposals.
- 1.5 The mitigation measures proposed have been identified in order to avoid and/or reduce the impacts caused by introducing the development proposals. The report currently considers these in the context of the illustrative masterplan. However, further design development and subsequent layout improvements will ensure the detailed design addresses flood impact and mitigation measures comprehensively prior to a Reserve Matters application being submitted.
- 1.6 This Flood Risk Assessment has been compiled in accordance with "National Planning Policy Framework (NPPF)" published by the Ministry of Housing Communities and Local Government in December 2024, "Technical Guidance to the National Planning Policy Framework" and 'CIRIA C624: Development and Flood Risk Guidance'.
- 1.7 The Environment Agency updated its flood mapping in March 2025 to better reflect the risk of surface water, fluvial and coastal flood risk. Figure1.1 below shows the extent of surface water flood risk over the BSL site.
- 1.8 This FRA has been revised to reflect the risk presented by surface water run-off.

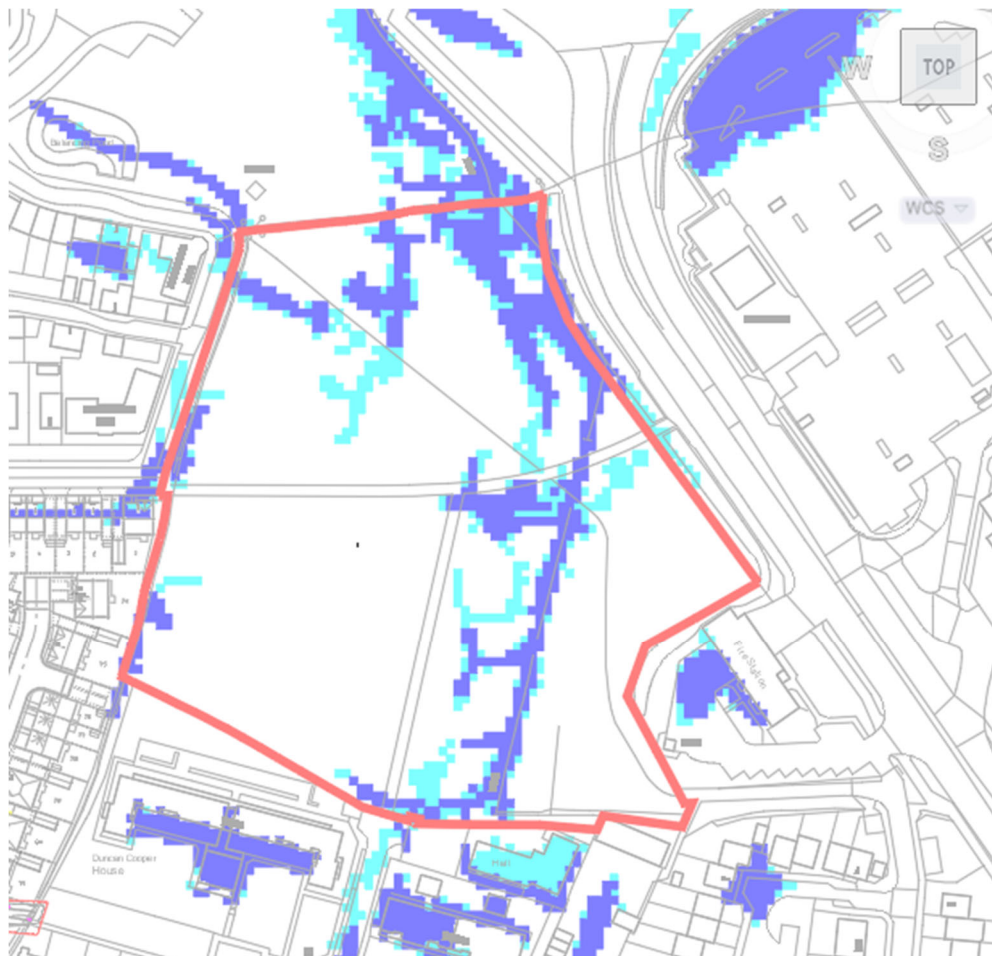


Figure 1.1 – Medium to High Surface water Flood Risk (Ref. EA Website)

2 Existing Site Description

Site Location

- 2.1 The application site is located off Maurepas Way, A3, in the south-east of Berewood and the south-west of Waterlooville. The surrounding area is predominately urban with residential property located to the south and west, and commercial property to the east beyond the A3. Refer to the site location extract in Figure 2.1 below.
- 2.2 The site falls under the administrative boundary of Havant Borough Council. The postcode is PO7 7PS and the approximate co-ordinates to the centre of the site are E467815, N109333.
- 2.3 The approx. 2 ha site consists of greenfield and contains a footpath running across the site.



Figure 2.1: Site Location

Topography

- 2.4 A preliminary topographic survey was undertaken in March 2023 by Grainger PLC and is included in Appendix B.
- 2.5 The levels on site fall from 50.766m AOD close to the south-western boundary of the site to 38.187m AOD in the north-western section of the site.

- 2.6 The site consists of greenfield land with an existing footpath stemming from Laxton Leaze to Maurepas Way, and Forest End.

Infiltration & Geology

- 2.7 BGS online geological records show the site to be underlain by London Clay Formation – Clay, silt, and sand. This suggests that infiltration drainage is unlikely to be feasible due to the poor permeability of Clay soil.
- 2.8 An intrusive Ground Investigation was undertaken in April 2023 by T & P Regeneration Ltd. The Investigation confirmed the BGS geological records showing London Clay present from 0.2mBGL to over 4mBGL.
- 2.9 Groundwater was not encountered within any exploratory holes and groundwater ingress is considered unlikely.

Hydrology

- 2.10 The main recipient watercourse for site runoff will be the River Wallington, which flows east to west and is located approximately 250m to the north of the site.
- 2.11 Appendix C shows the existing flow paths and ditch network with associated culverts present on the site.
- 2.12 The site is bordered on all sides by field ditches typical of the adjacent Berewood site prior to development. Generally, overland flows are collected by the existing ditch networks and flow to the north.
- 2.13 In addition, a ditch runs across the middle of the site from the southern boundary to the north-east corner. The ditch intercepts the southern boundary ditch and a 600mm diameter culvert, which drains the Forest End estate to the south.
- 2.14 The ditch outfalls to a culvert, which flows under Maurepas Way, then discharges to the southern water network at Maurepas Way Roundabout.

3 Proposed Development

- 3.1 The development proposal is for a new 69-unit residential scheme containing an open attenuation water storage feature, an access road, and associated parking. Please see Appendix D and Figure 3.1 below for the Illustrative Site Masterplan.



Figure 3.1: Illustrative Site Masterplan

- 3.2 The development is located in a low-risk Flood Zone 1 area as shown on the Environment Agency (EA) flood Map for planning (Appendix A), so the proposed levels will be dictated by the boundary and engineering constraints as opposed to a predicted fluvial or tidal level. The levels in the proposed development aim to match existing ground levels where possible to minimise the volume bulk earthworks.

4 Flood Risk Overview and Mitigation Measures

4.1 In theory, there are five types/sources of flooding that could affect the proposed development. These are described below with proposed mitigation measures outlined where necessary.

- **Fluvial** – The site is located in a low risk Flood Zone 1. This means that it has an annual probability of <0.1% of experiencing flooding from fluvial sources. There are no mitigation measures required and it will not be addressed further in this report.
- **Tidal** – The site is located in a low risk Flood Zone 1. This means that it has an annual probability of <0.1% of experiencing flooding from tidal sources. There are no mitigation measures required and it will not be addressed further in this report.
- **Groundwater** – The Preliminary Flood Risk Assessment undertaken by Hampshire County Council, provides a map showing areas susceptible to groundwater flooding. From the map, the site is located in an area that has less than 25% susceptibility to groundwater flooding (Appendix D). Moreover, the Partnership for Urban South Hampshire (PUSH) SFRA interactive map shows that there are no recorded groundwater flood incidents at or close to the site, please see Figure 4.1 below. Therefore, it is considered that the risk of groundwater flooding at the site is low, meaning that no mitigation measures are required and it will not be addressed further in this report.

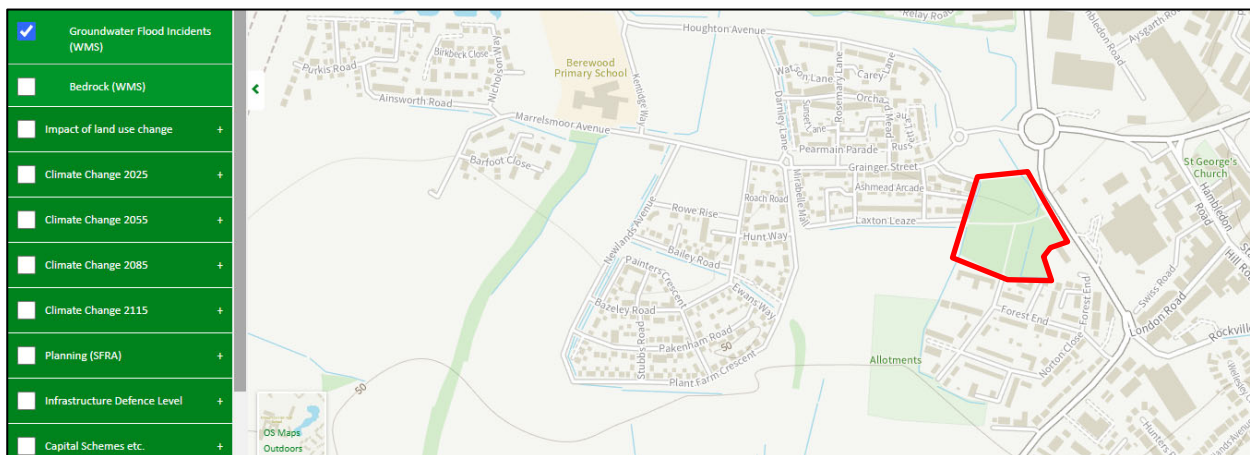


Figure 4.1: PUSH SFRA Recorded Groundwater Flood Incidents Map

- **Surface Water Runoff** – The EA Surface Water Flood Risk Map (Appendix E) indicates that there is a medium to high risk of surface water flooding at the site. A review of the EA's surface water flood information in conjunction with the topographic survey has been undertaken and is discussed in Section 5 of this report. The drainage strategy for the development is provided in Appendix G.

- **Infrastructure Failure** – The PUSH SFRA interactive map shows that there are no previously recorded sewer flooding incidents at or close to the application site according to Southern Water records, please refer to Figure 4.2 below. Therefore, it is considered that the risk of infrastructure failure at the site is low, meaning that no mitigation measures are required, and it will not be addressed further in this report.

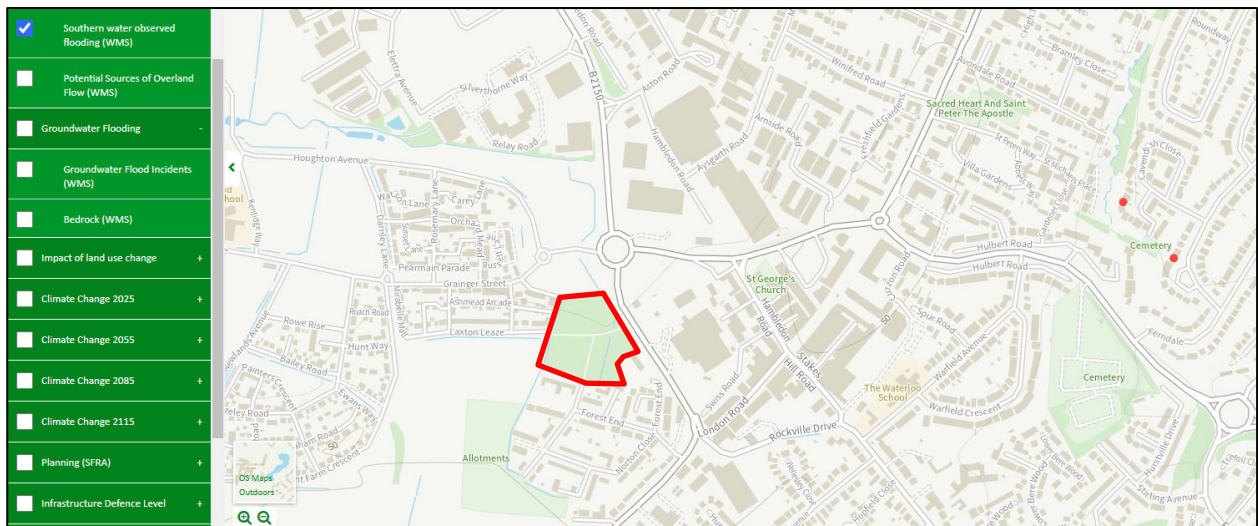


Figure 4.2: PUSH SFRA Recorded Southern Water Sewer Flooding Incidents Map

5 Surface Water Flood Risk

5.1 The EA surface water flood map identifies areas of medium to high risk of surface water flooding located within the BSL site. Refer to Figure 5.1 below.

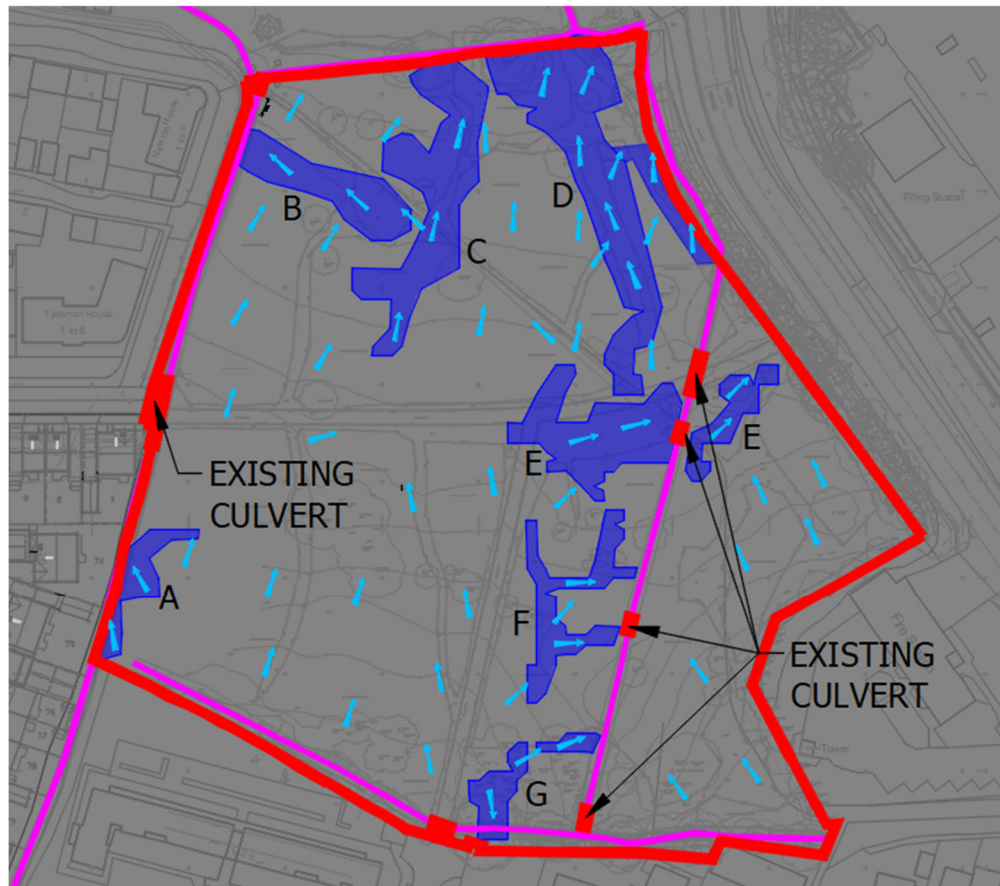


Figure 5.1: Indicative Medium and High Risk Surface Water Flood Areas

5.2 Figure 5.1 identifies the areas of medium / high surface water flood risk (referenced A to G) within the application site, based on the latest EA Flood Mapping, which are associated with the existing ditch network.

- Area A corresponds with a localised area which falls towards the existing ditch on the western boundary. No development is proposed in this area, so it will remain as existing and not pose a flood risk to the development proposals, and the development proposals will not increase flood risk elsewhere.
- Area B corresponds with a localised area which falls towards the existing ditch on the western boundary. The flood risk area falls towards the ditch and is therefore showing water in transit generated on the site itself. The proposed surface water drainage strategy for the site will collect and positively drain all surface water

removing the source of the surface water flooding, and the associated risk. The proposed surface water drainage strategy is provided in Appendix G.

- Area C is where the ground levels form a very shallow valley falling from south to north. Consequently, the area will drain to the ditch along the northern boundary. The proposed surface water drainage strategy for the site will collect and positively drain all surface water from area to be developed thereby removing the source of the surface water flooding, and the associated risk.
- Area D coincides with areas comparatively free of trees and heavy overgrowth. Area D has a nominal gradient of 1 in 46 and drains to the existing ditches on the northern and eastern boundaries. A flow path will be maintained to ensure surface water continues to drain towards the eastern and northern ditches. There is no development proposed in this area apart from open space amenity and SuDs provision.
- Area E is directly related to the culvert, which passes under the existing footpath. The culvert conveys the flow from the existing ditch underneath the existing path. The proposed surface water drainage strategy for the site will collect and positively drain all surface water removing the source of the surface water flooding, and the associated risk. Flow paths to the existing ditch will be maintained.
- Area F is a consequence of another culvert which currently does not support any particular feature (e.g. path or road). It is likely the culvert was constructed to provide access when the site was used for allotments but is now redundant. The surface water flood risk areas are generated by the site itself, so the proposed surface water drainage strategy will collect and positively drain all surface water removing the source of the surface water flooding, and the associated risk.
- Area G appears to be an anomaly possibly due to the large trees in this area disrupting the collection of ground levels during the LIDAR survey. The general fall of the ground is eastwards towards the ditch so it is likely the area drains to the ditch to the east. The surface water flood risk areas are generated by the site itself, so the proposed surface water drainage strategy will collect and positively drain all surface water removing the source of the surface water flooding, and the associated risk.

5.3 Paragraph 5.2 and its sub-sections identify that the areas of surface water flood risk identified on the EA mapping would all either continue to drain to the existing ditch network, matching the existing situation without impacting the proposed development, or would be positively drained by the proposed SuDS system serving the site, removing the risk.

- 5.4 Areas C to G are all directly associated with the existing ditch running across the site.

Existing Ditch Network

- 5.5 The existing ditch network is indicated on Dwg. GTWVILLE_BSL/DR/01 in Appendix C. The ditch which crosses the centre of the site commences at the Forest End Estate on the southern boundary and discharges to a culvert on the eastern boundary. The culvert then crosses the Maurepas Way highway before reconnecting to the southern water network at Maurepas way roundabout.
- 5.6 The headwall at the ditches discharge point is heavily silted and requires clearing to ensure it operates as intended.



Figure 5.2: Approach to culvert

- 5.7 In the existing situation if the capacity of the ditch was exceeded water would spill onto the adjacent land and continue its route to the headwall, where it would enter back into culvert to the north and continue downstream.
- 5.8 Following discussions with Hampshire County Council (Lead Local Flood Authority), at a meeting on 07.07.25, it was agreed that a capacity assessment of this ditch would be undertaken. It was noted that the ditch posed a flood risk if it is undercapacity.
- 5.9 To assess the capacity of this ditch, the upstream catchments were identified, and referenced as Catchment A to E (refer to Appendix G).
- 5.10 To calculate the runoff passing through the ditch percentage impermeable areas were calculated, and greenfield runoff rates including appropriate growth factors were applied, see the summary below (refer to Appendix G for full calculations):
- Catchments A, B, D and E are all soft landscaping, so a percentage imperviousness (PIMP) of 10% was applied.
 - Catchment C contains the Forest End estate, which contains impermeable areas of approximately 50%, however 60% was used to remain conservative. A PIMP of 100% and 10% was applied to the impermeable and permeable portions respectively.
 - An M5/60 rainfall rate of 19mm/hr was used to calculate the m5/60 discharge rate, and growth factors of 2.4 and 3.19 were used for the M30 and M100 rates respectively.
 - This exercise identified that the flow rates through the ditch are anticipated to be as outlined below:
 - M5: 200.7l/s
 - M30: 481.6l/s
 - M100: 640.1l/s
- 5.11 A number of cross sections of the ditch and culverts were extracted from the topographic information to assess capacity (refer to Appendix G for full calculations). This identified that the capacity of the existing ditch and associated culverts varies having capacities between 101.9l/s and 1132l/s,
- 5.12 In the existing situation water would spill out of the ditch and flow parallel to it, until it discharged back into the existing culvert at the northeastern section of the site.

- 5.13 It is proposed to preserve and enhance the ditch and associated culverts to ensure the ditch section through the site has capacity to convey the flows to the downstream culvert. The proposed design parameters for the ditch will be:
- Minimum Culvert parameters (required for existing and new culverted sections)
 - 600mm diameter
 - Nominal 1in40 gradient
 - 970l/s flow capacity
 - Minimum Ditch Parameters
 - 4.64m² Cross Sectional Area
 - Nominal 1in40 gradient
 - 1339.8l/s flow capacity
- 5.14 Further development of the ditches design will be carried out in conjunction with the development layout to inform a Reserve Matters application when it is issued in due course. The ditch would be an integral part of the overall layout.
- 5.15 The proposed upgrades to the existing ditch and culvert sections through the site would result in sufficient capacity through the system to convey the flows from the upstream network and catchments to the culvert downstream.
- 5.16 Paragraphs 5.9 to 5.14 demonstrate that following the ditch and culvert upgrades the surface water would be safely contained in the channel prior to discharging to the existing culvert. The upgrades will result in the same volume and rate of water reaching the existing culvert, however rather than travelling overland (in the sections where there is insufficient capacity in the ditch / culverts), it would be safely contained in the ditch / culverts, which ensures surface water flood risk downstream is not increased. Beyond the site, the existing culvert surface water drainage network will convey flows downstream to their ultimate outfall as in the existing situation.

Design Considerations

- 5.17 Overland Flow paths across the site will be maintained either on their existing route or an appropriate diverted route. Figure 5.3 shows where flow paths can be accommodated within the illustrative masterplan below.



Figure 5.3: Proposed Overland Flow Paths (Illustrative Masterplan)

- 5.18 Finish floor levels in the lower parts of the site should be set above ground level and properties with level access should ensure access locations are not situated within overland flow paths.
- 5.19 The SuDs basin will have a minimum 0.5m upstand around it's rim to divert overland flood flows around its eastern and western sides, so that storage during storm events isn't compromised.
- 5.20 The existing ditch and culverts will be upgraded to the following minimum parameters to ensure sufficient flow capacity is available:
 - Minimum Culvert parameters (required for existing and new culverted sections)
 - 600mm diameter
 - Nominal 1 in 40 gradient
 - 970l/s flow capacity
 - Minimum Ditch Parameters
 - 4.64m² Cross Sectional Area
 - Nominal 1 in 40 gradient
 - 1339.8l/s flow capacity

6 Conclusion

- 6.1 The EA flood maps indicate that the site is located in a low risk Flood Zone 1 area so the proposed levels will be dictated by boundary and engineering constraints as opposed to a predicted fluvial or tidal flood level.
- 6.2 The development site has a low risk of flooding from the following sources: Fluvial, Tidal, groundwater, and Infrastructure Failure, so the proposed levels will be dictated by boundary and engineering constraints and by their impact on surface water flood risk.
- 6.3 Overland flow paths will be preserved where possible or substituted with adequate alternative routes within developed areas.
- 6.4 The surface water flood risk areas are generated by the site itself, so the proposed surface water drainage strategy will collect and positively drain over 65% of all surface water, significantly reducing the source of the surface water flooding and the associated risk.
- 6.5 The ditch crossing the middle of the site and the associated culverts will be upgraded to ensure sufficient capacity to convey upstream flows, and redundant culverts will be removed. The design will be submitted for Ordinary Water Course consent once a detailed design is available.
- 6.6 The design initiatives proposed in Section 5 will ensure the development has sufficient resilience to flooding.

Flood Mechanism	Source	Flood Risk to the Development	Mitigation Required?
Fluvial	N/A	Low	No
Tidal	N/A	Low	No
Groundwater	Underlying geology and groundwater levels	<25%	No
Surface Water / Overland Flow	Runoff from surrounding elevated land.	Medium to High	Natural flow paths to be maintained. Ditch / culvert to be upgraded.
Infrastructure Failure	Surface water systems and Water mains	Low	No

Table 7.1: Flood Risk Summary

6.7 The conclusion is that the proposed development at Blue Star Land, Waterloooville, PO7 7PS, can be safely drained without increasing the risk of flooding to downstream/surrounding properties.

APPENDIX A: EA Indicative Flood Map

APPENDIX B: Topographic Survey

APPENDIX C: Existing Overland Flow Paths

APPENDIX D: Illustrative Site Masterplan

APPENDIX E: Susceptibility to Groundwater Flooding Map

APPENDIX F: EA Surface Water Flood Risk Map

APPENDIX G: Ditch Catchment Areas and Capacity Calculations

Appendix H: Proposed Drainage Strategy

