

Cereal Partners UK Staverton,
Trowbridge, Wiltshire BA14 6PG

Whitehorse Factory

Flood Risk Assessment and Drainage Strategy

Revision V1

27th November 2025



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Quality Assurance

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1.0 Introduction

Cereal Partners UK (CPUK) at Staverton produces and distributes cereals. It also undertakes research into their products. It is an important employer in the area.

CPUK proposes a new factory located on the existing service yard at the Staverton site, to supplement their existing activities. The remaining service yard will continue to be used as service yard.

The site is shown on the Environment Agency's (EA) Flood Map for Planning to be in Flood Zones 2 and 3 and the planning application therefore needs to be accompanied by a Flood Risk Assessment (FRA). The EA has informed us that the maps were produced by JFLOW, and the EA advises that these are not suitable to rely upon for FRAs.

CPUK has therefore appointed Edenvale Young (EY) to undertake flood modelling which has been completed and reviewed by the EA as part of 'Cost Recovered Advice, Ref: ENVPAC/1/WSX/00406'. The EA has subsequently confirmed that the model is 'Fit for Purpose', although there are some minor clarifications which have been provided.

The modelling has revealed that the Design Flood Event remains in the channel and does not flood the site.

CPUK is installing high containment kerbs for improved vehicle and pedestrian safety, and as a precaution to reduce future extreme flood risk. This is the subject of a separate current planning application. A further separate application is being submitted to improve the site main entrance and reduce congestion on the public highway.

This FRA focuses on the impact of the new factory only, and deals with flood risk (relying on the approved EY modelling) and surface water drainage.

2.0 Site location

The proposed factory (referred to as the Site) is located to the northeast of the existing factory at CPUK Staverton, Trowbridge, Wiltshire BA14 6PG, in the following setting;

- Northwest of the Site is a retained macadam access area for pedestrians and service vehicles, abutting the Weston Cut, which Main River and is a leat to the River Avon, which in turn is to the north.
- Northeast of the Site is the main service yard with occasional storage, beyond which includes the base of a former settlement tank, a substation and a landscaped area for staff amenity. The River Avon flows east to west with a weir to feed the leat/Weston Cut.

- Southeast of the Site is more access and storage area with a grass margin, public footway and railway on embankment. The railway passes over the River Avon.
- Southwest of the Site is the existing factory complex with the main access onto the B3105 which leads southwards into Staverton and Trowbridge and crosses the leat and River Avon.

The Site is therefore located on the existing service yard and abuts the existing factory complex. The land is generally a level plateau at about 31.8m AOD

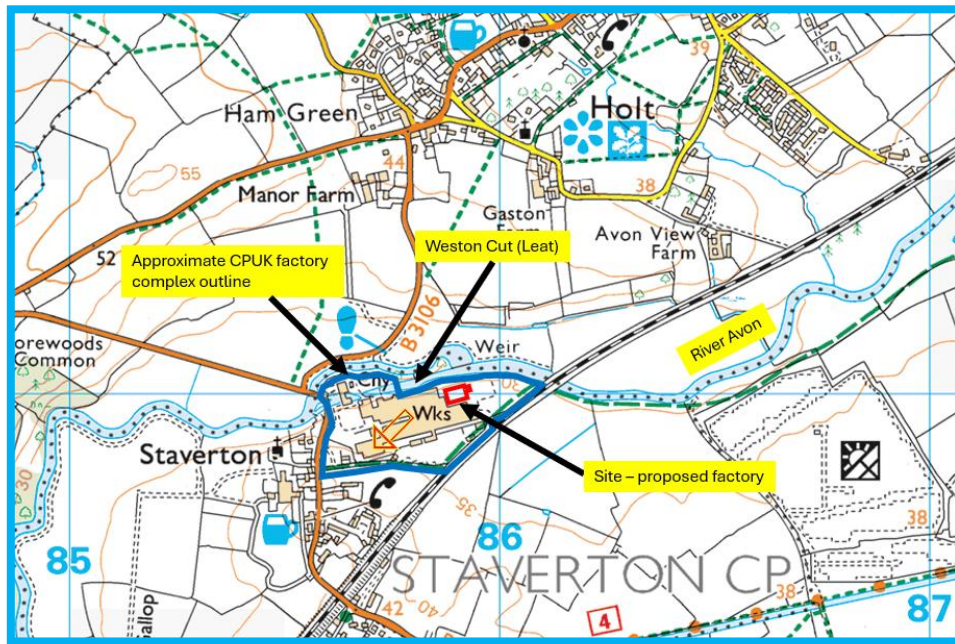


Figure 1 Site location (Streetmap)

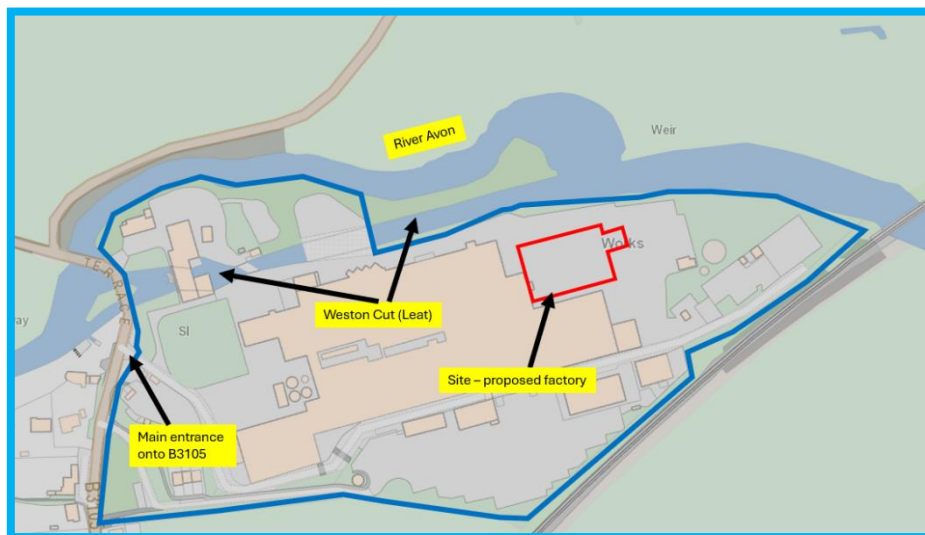


Figure 2 Site outline in relation to factory site (Know your Place)



Figure 3 Location of Site on existing macadam and concrete service yard.
(Google Earth).

3.0 Site Description

The factory site has been inspected by the author of this FRA on 27th Marh 2025, 14th March 2024 and at other times, during which the photographs were taken.

The Site is currently a macadam and concrete service yard used for access and temporary storage.

A detailed topographic and utility survey has been undertaken and shows that the levels within and in the vicinity of the Site vary from 31.67m AOD at gulleys to 32.02m AOD, but the site is generally at 31.8m AOD.

The nearest point of the building to the top of bank of the Weston Cut is 10.7m, providing the space for the vehicle manoeuvres and a safe pedestrian walkway.

The building location is over utilities and drainage which will be diverted as appropriate (designed by others).

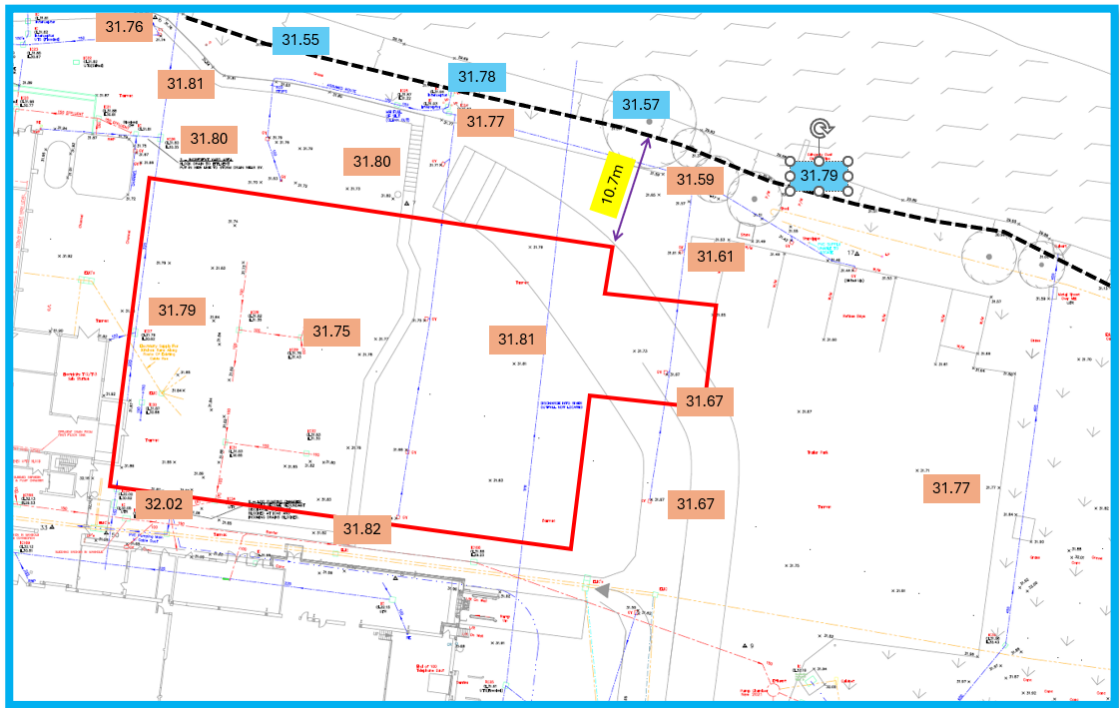


Figure 4 More detailed image of site area showing general arrangement.



Figure 5 Panoramic image of existing site, with approximate outline of proposed factory in yellow broken line.



Figure 6 Bank of Weston Cut north of proposed factory.

4.0 Proposed Factory

The proposal is to form a simple rectangular factory unit, with pitched roof and a lowered loading dock to suit the deliver lorries. The west end of the building will be connected to the existing factory for access.

The existing factory has a Finished Floor Level (FFL) of 32.1m AOD. In accordance with good practice, it is proposed to form the new factory with an FFL of 32.4m AOD – raising it 300mm above existing. There is therefore no proposal for flood resilience etc.

The existing drainage and utilities will be adapted to the new building or diverted around the building (design by others).

The closest part of the building to the Weston Cut will be 10.7m, and no Flood Risk Activity Permit (FRAP) will be required.

The building will have conventional gutters and downpipes connected into a conventional underground drainage system, which will connect into the existing drainage system, avoiding a new outfall into the Weston Cut.

The loading dock will be covered, but drained by pump due to its low level in case of rain dripping off lorries and driven rain.

The factory will be constructed through the existing service yard paving with minimum disturbance of the retained service yard, and the surface made good. It will be appreciated that the existing factory must continue production, so the impact outside the new footprint of the new building will be minimised.

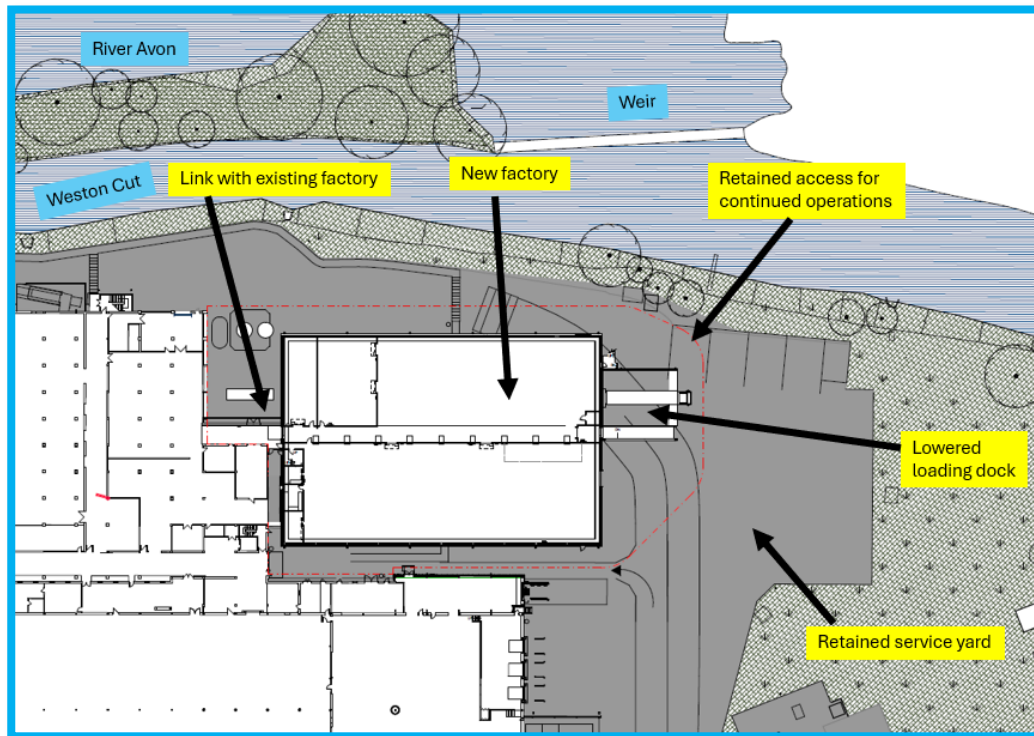


Figure 7 Proposed factory within existing service yard

5.0 Flood Risk

5.1 Fluvial Flood Risk

The proposed factory is shown to be partly in Flood Zone 2 (medium flood risk) and partly in Flood Zone 3 (high flood risk), according to the EA Flood Map for Planning, although the levels are generally similar across the footprint of the Site. The Weston Cut adjacent the site is Main River, as is the parallel River Avon.

The proposal is for Less Vulnerable development, and according to Table 2 of the Flood risk and coastal change Guidance (PPG), this is appropriate and is not required to pass the Exception Test.

However, the Long Term Flood Risk Rivers and sea Map shows the Site outside the area at risk of flooding in the current day, and Low chance of flooding with climate change allowance.

The EA have advised in their Product 4 response that this mapping is based on JFLOW.

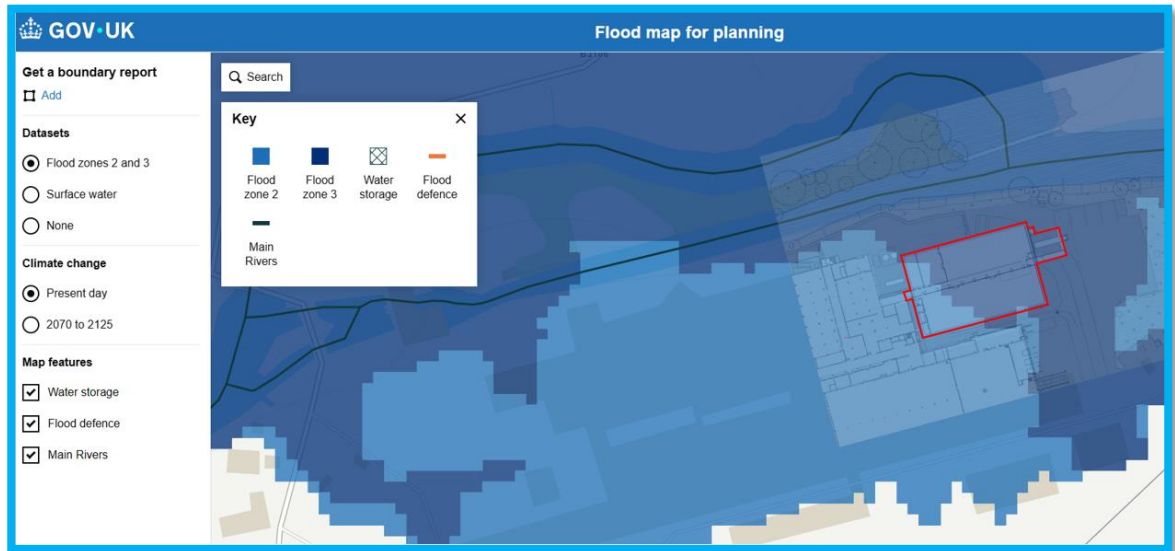


Figure 8 EA Flood risk map for Planning showing red outline of factory in Flood Zones 2 and 3.

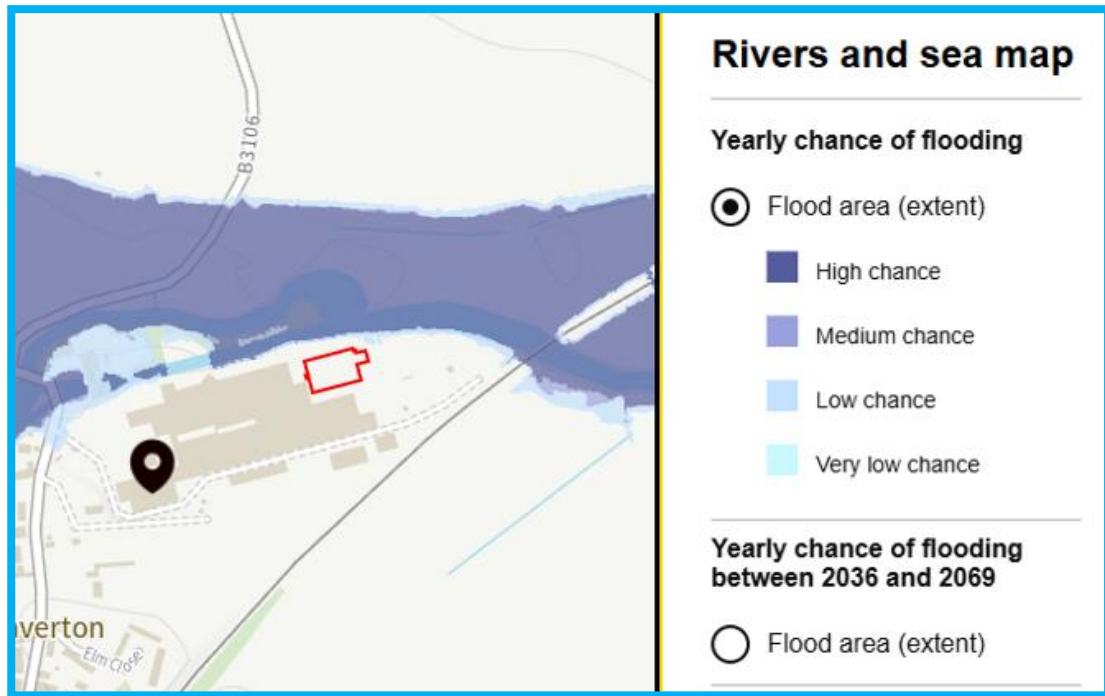


Figure 9 EA Long Term Flood Risk Rivers and sea map showing the Site outside the area at risk of flooding in the current day (ie outside the 1 in 1000 year event)

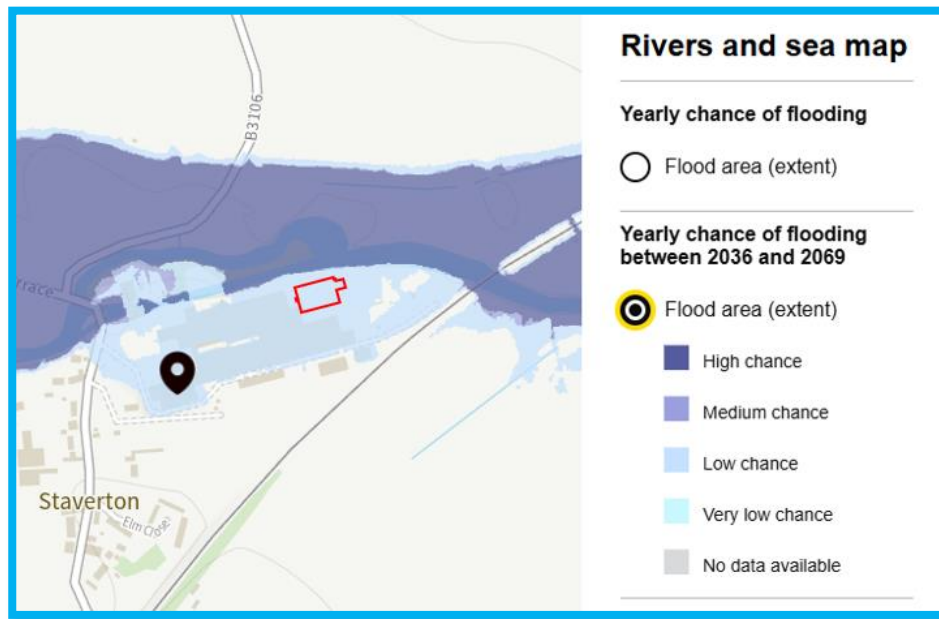


Figure 10 EA Long Term Flood Risk Rivers and sea map showing the Site at Very low chance of flooding with climate change (ie beyond 1 in 100 year event)

However, as the above EA mapping is based on JFLOW, Edenvale Young Associates Ltd (EYV) have undertaken detailed site-specific flood modelling based on a detailed channel survey up and downstream of the site and new hydrology. This modelling confirms that the flood plain north of the factory site is predicted to flood (ie the River Avon flood plain), but that the site is raised above the predicted flood levels in the Weston Cut (and River Avon).

The flood model and report have been submitted to the EA as part of 'Cost Recovered Advice, Ref: ENVPA/1/WSX/00406'. The EA has confirmed that the model is 'Fit for Purpose' although there are some minor clarifications being provided.

As a Less Vulnerable development, the Central allowance is the appropriate assessment, and a test for the Upper End has also been undertaken. The peak River flow allowances confirm that they are 26% for Central and 71% for Upper End.

Despite being a commercial development, and the lifetime being 75 years, the 2080's time-frame has been adopted for this Assessment.

The Central level is the Design Flood Level (DFL) at 31.66m AOD at the upstream end of the Site. The results of the modelling show that at the gully (low) points the Site is 500mm above the Central level (DFL), and 176mm above the Upper End. However, the area of the Site is generally 31.7m AOD and the proposed factory FFL is at 32.4m AOD.

There is no requirement therefore for flood compensation, and the proposed factory floor is more than 1.2m above the DFL and safely above Upper End as a test for more extreme floods.

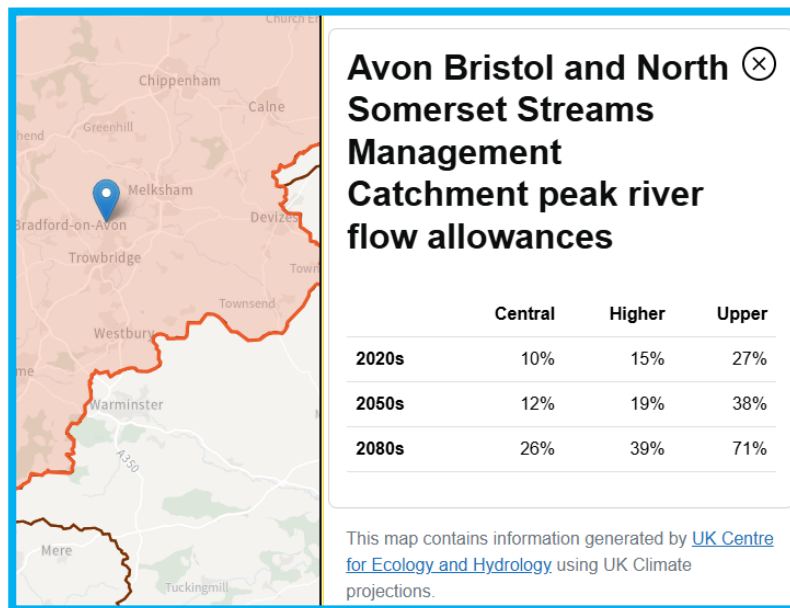


Figure 11 Peak river flow allowances

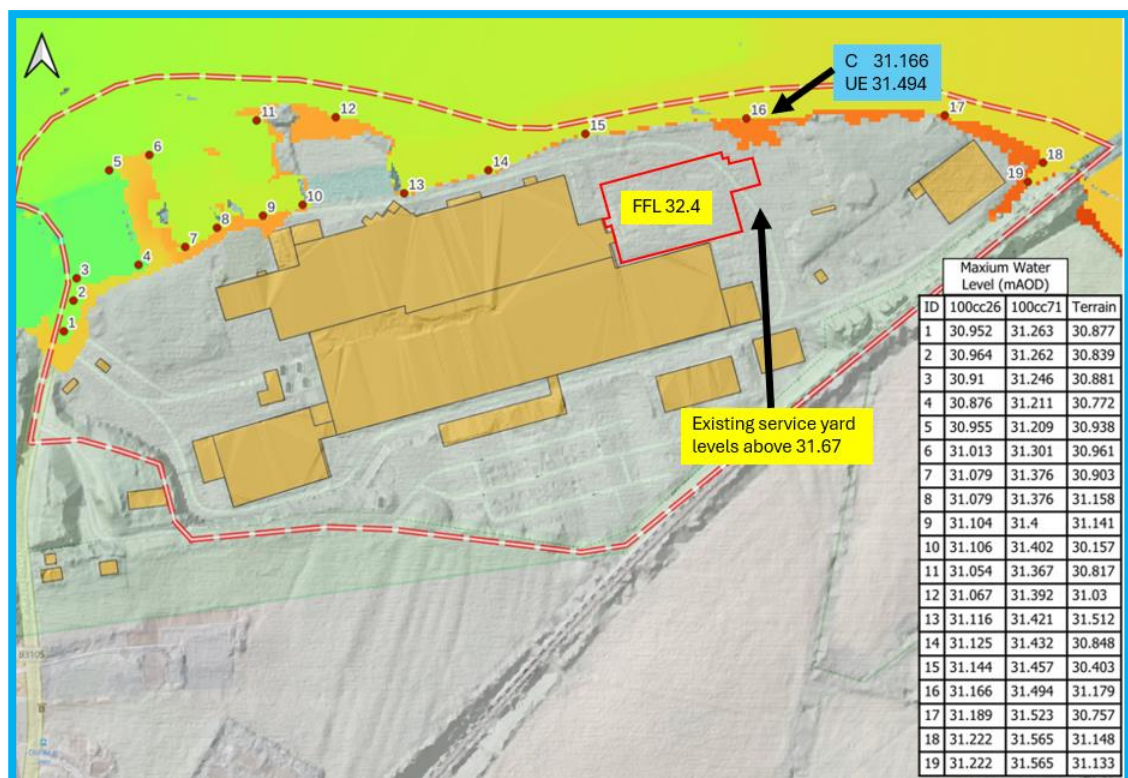


Figure 12 Output from the approved site specific flood model by EVY showing sample points and predicted flood levels. Note there is a low area due to localised settlement at Point 16, but outside the Site.

This site-specific Flood Risk Assessment has therefore shown that the Site is at very low risk of flooding, and has improved accuracy over the JFLOW national scale modelling. The development does not require flood compensation and the FFL has been raised 300mm in accordance with good practice. The proposal is therefore appropriate in terms of fluvial flood risk.

5.2 Surface Water Food Risk

The EA Surface Water Flooding Maps have been inspected and show localised ponding in the climate change scenario at gully positions. The EA surface water modelling does not take into account localised drainage, and as there are gulleys at these positions, there is no expectation of flooding. No flooding has been recorded at the site

The EA surface water flooding does not show any predicted ponding with climate change deeper than 200mm.

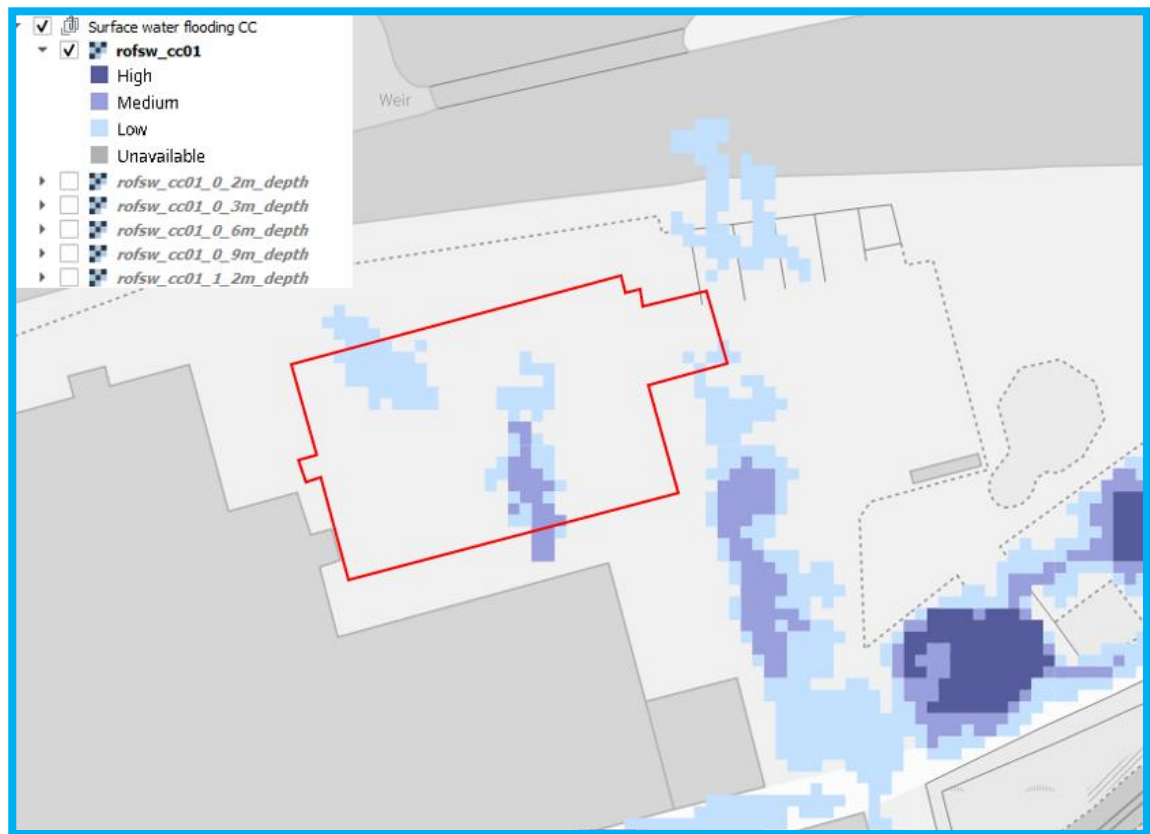


Figure 13 Predicted surface water ponding with climate change allowance, showing it along the gully 'valleys'. (EA QGIS layer).

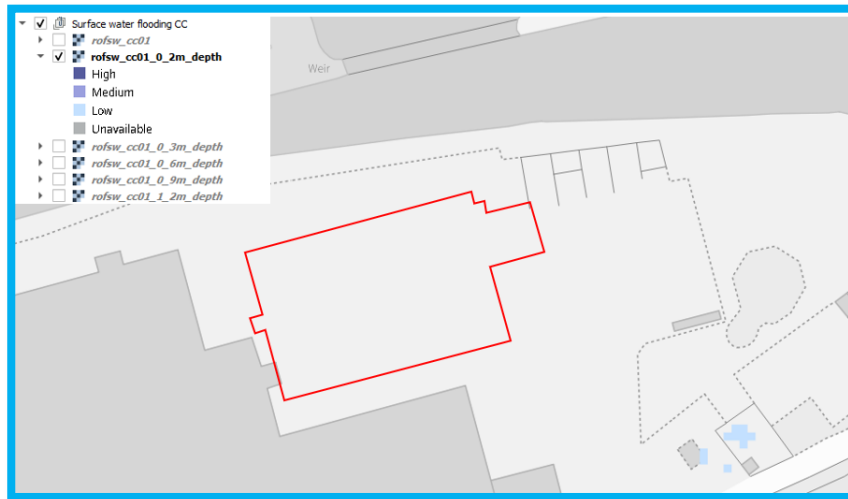


Figure 14 Predicted surface water ponding with climate change allowance showing no flooding deeper than 200mm. (EA QGIS layer).

5.3 Other Sources of Flooding

The groundwater level within the site will be related to the seasonal water level in the Weston Cut (leat) and River Avon, which is at 29.6m AOD, some 2m below the ground level within the site. From the modelling, the 1 in 20 year event is at 30.8m AOD, 1m below the general site level. There is no record of groundwater flooding in the factory or during excavations, and so this risk is very low. However, these figures would prevent the use of soakaways or an open infiltration/attenuation pond.

Reservoir flooding has been inspected using QGIS. In dry weather there is no predicted risk of flooding, but in wet weather a risk of flooding is predicted, but curiously this stops shortly past the site. The source of flooding is unknown but very remote from the site. It is again acknowledged in the EA guidance that this is a low risk and the proposed factory floor is likely to be above the predicted depth.

In terms of sewer flooding, there are no sewers in the area. There are only localised drains associated with the factory, and the proposed FFL is more than 300mm above the surrounding service yard. The risk of sewer/drain flooding is therefore very low.

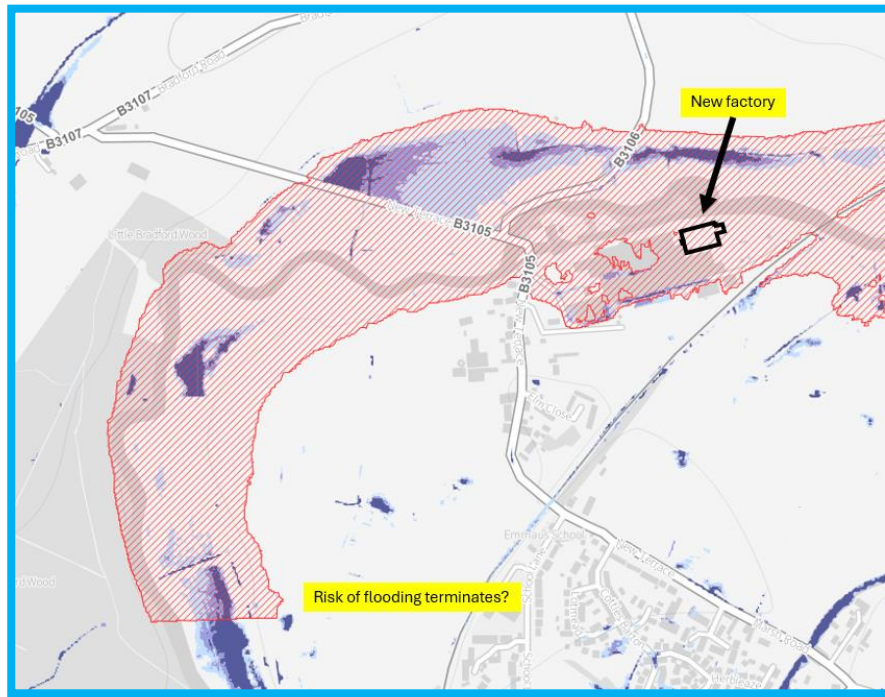


Figure 15 Risk of reservoir flooding.

6.0 Flood Mitigation

This site-specific flood risk assessment has shown that the site is at very low risk of flooding. The FFL of the new factory has been raised a precautionary 500mm above the service yard (and 300 mm above the existing factory floor) level, and so no flood resilience is considered necessary nor is it proposed.

7.0 Sequential Test

The site specific flood modelling and this Assessment show the Site to be at very low risk of flooding. The Site should therefore be categorised as Flood Zone 1 and not subject to the Sequential Test.

However, the site processes require the factory to be located at this site for sustainable efficient operations.

Furthermore, Paragraph 027 of the Flood and Coastal change Guidance (ie the PPG) includes the following paragraph, supporting the approach adopted above, and explains that the Sequential Test need not be applied.

In applying paragraph 175 a proportionate approach should be taken. Where a site-specific flood risk assessment demonstrates clearly that the proposed layout, design, and mitigation measures would ensure that occupiers and users would remain safe from current and future surface water flood risk for the lifetime of the development (therefore addressing the risks identified e.g. by Environment Agency flood risk mapping), without increasing flood risk elsewhere, then the sequential test need not be applied.

Figure 16 Exact from current PPG Paragraph 027 indicating that the sequential test need not be applied, based on this site specific FRA.

A pragmatic approach needs to be taken where proposals involve comparatively small extensions to existing premises (relative to their existing size), where it may be impractical to accommodate the additional space in an alternative location. Equally, where there are large areas in Flood Zones 2 and 3 (e.g. coastal towns and settlements on major rivers) and development is needed in those areas to sustain the existing community, sites outside them are unlikely to provide reasonable alternatives.

Figure 17 Exact from current PPG Paragraph 027a indicating that the sequential test need not be applied, based on this site specific FRA.

8.0 Surface Water Drainage

Whilst the Site currently drains freely by gulleys to the Weston Cut, it is proposed to attenuate the runoff from the new factory area to provide betterment.

The drainage serving the areas outside the factory footprint will be diverted and kept separate from the new factory drainage. This diversion design is being undertaken by others in conjunction with the other underground utilities.

In the Wiltshire Council Drainage and Betterment Strategy (June 2024) the LLFA gives guidance on the appropriate measures for betterment in paragraph 2.2.

2.2 - Brownfield Sites:

- For brownfield sites, the peak runoff rate from the development to any drain, sewer or surface water body for all return period between the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event.
- At all stages of the planning process, when developing a brownfield site and once it has been proven that discharging to the Greenfield rate (or matched rates) or as close as feasibly possible is not possible, discharge rates should be restricted to provide a minimum 30% betterment over existing discharge rates for the brownfield site.

The LLFA expects surface water drainage schemes on brownfield development sites to follow the same principles as if the site is greenfield.

Figure 18 Drainage strategy for brownfield sites.

Based on the above, a discharge rate will be used with 30% betterment of the 1 in 1 year pre-development runoff rate from the factory Site . The remaining service yard will be very constrained, and the attenuation tank will be very shallow, thus restricting use by HGV's. This has prevented a larger tank and lower discharge rate being used. The tank also needs to avoid existing electric cables etc.

The proposed factory will have a conventional pitched roof with gutters and rainwater pipes dropping each side. These will be collected by carrier drains north and south of the factory to an attenuation tank under the east side of the existing service yard, to avoid the area used by HGVs.

The attenuation tank will drain into the nearby 450mm dia. drain which outfalls to the Weston Cut.

A shallow drainage system is proposed, which will maximise the duration of drainage by gravity. If storms occur during high water levels, a pump will assist the discharge to the Weston Cut, at the rate of 22l/s, to match the gravity outflow rate, and serve the attenuation tank.

The following criteria will apply;

- Drainage design based on a 1 in 100 year storm with 45% climate change allowance
- A gravity underground drainage system conveying runoff from downpipes to the attenuation tank by gravity.
- Drains will be shallow and concrete encased in narrow trench
- Outlet flow from attenuation tank restricted to 1 in 1 year pre-development event with 30% betterment – this is calculated at 23.8 l/s, and a precautionary figure of 22 l/s is used

- Flow control by vortex flow control device , such as Hydrobrake.
- Considering a range of storms, the tank volume needs to be 82m³ minimum (last page of calculations in Appendix)
- The flow will discharge into the existing 450mm drain, more than 10m from the bank of the Weston Cut.
- The drain discharges into the Weston Cut at 29.7m AOD
- A non-return valve will be attached to the existing outfall
- Normal water level in the Weston Cut is about 29.6m AOD
- The base of the tank is at 30.1m AOD, so will operate by gravity most of the time.

A Downstream Defender Select by Hydro International (or similar) is proposed upstream of the attenuation tank to treat the stormwater and remove pollutants.

The lowered loading dock will be covered for reasons of hygiene. However, a gully and pump will be installed to capture rainfall runoff from vehicles and driven rain.

<u>Pre-development Discharge Rate</u>			
Site Makeup	Brownfield	Time of Concentration (mins)	6.00
Brownfield Method	MRM	Betterment (%)	30
Contributing Area (ha)	0.279	Q 1 year (l/s)	23.8
PIMP (%)	90	Q 30 year (l/s)	56.6
CV	0.750	Q 100 year (l/s)	72.1

Figure 19 Extract from calculations in Appendix showing 30% of pre-development runoff giving the permitted discharge rate of 23.8 l/s

Customise the capture and retention of sediment, oils and floatables from stormwater runoff over a wide range of flows in a small footprint.

The Downstream Defender® Select is the new generation of hydrodynamic vortex separator for treatment of stormwater runoff to protect the environment and meet water quality requirements. Engineers can customise the performance of the unit to meet specific stormwater quality objectives through model selection and other additional options. An extended range of chamber sizes allows engineers to tailor their drainage designs to meet specific pollutant removal standards.

The Downstream Defender® Select also offers easier installation with much more flexibility of pipe sizes and connections and can accept up to three inlets.

Design and customise your own Downstream Defender® Select. Log in or register for the free tool: hydro-int.design

Figure 20 Runoff water quality improvement of Downstream Defender Select by Hydo International.



Figure 21 Existing headwall, typical of headwall at discharge point

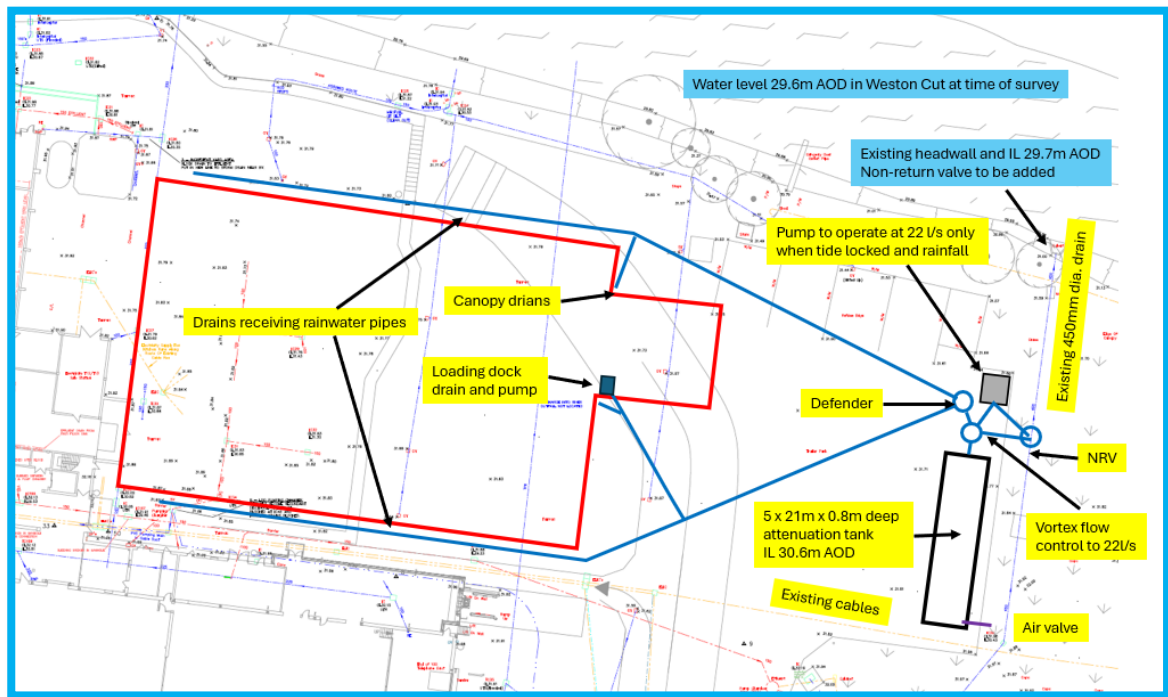


Figure 22 Drainage Strategy with key points

9.0 Designing for Exceedance

Drainage will be designed to convey and manage the 1 in 100 year event with climate change allowance.

Rainfall intensities exceeding the design rainfall will spill onto the paving, as previously, and flood the paving before overflowing into the river.

The proposed building will be raised about 500mm above the paving, and the existing factory is 200mm above the paving, providing surface capacity for more than a day's rainfall.

10.0 Maintenance

A conventional attenuated gravity drainage system is proposed and the maintenance will be included in the factory's already rigorous annual maintenance regime.

The loading dock and tide lock pumps will also be included in the maintenance regime, which is undertaken during the annual factory closure for maintenance of all site facilities.

11.0 Safety

The flood modelling has shown that the factory site is above the level of flooding in the river and Weston Cut; there is therefore 'dry' safe access within the site and up to the high level car park and then onto the B3105 into Trowbridge.

12.0 Conclusions

CPUK occupies a production, distribution and research site at Staverton.

CPUK proposes a new factory building to supplement their existing operations.

The EA Flood Map for Planning shows the Site to be in Flood Zones 2 and 3, at high risk of flooding.

The flood mapping is based on JFLOW, so Edenvale Young has undertaken site specific modelling of the River Avon, which has been submitted for 'Cost Recovered Advice', and the EA has confirmed the modelling is fit for purpose, with a few queries which have been submitted to the EA.

The modelling shows that the Design Flood Event is within the main channel of the Weston Cut, and the site is not expected to be at risk of flooding even in the Upper End event. Small areas of the wider site have settled, and are at risk of flooding in the Upper End climate change event, but these do not impact on the Site.

The proposed factory FFL has been raised 300mm above the existing as a precautionary measure and to avoid the need for flood resilience.

The factory will be located on part of the existing impermeable service yard, which drains freely into the Weston Cut.

In accordance with Wiltshire Council's Betterment Guidance, the runoff from the factory will be attenuated to 30% below the pre-development runoff rate, for all events up to the 1 in 100 year event with climate change allowance. The system will be relatively shallow and will operate by gravity. However, when the system is tide-locked, the tank will be over-pumped at the controlled rate. The tank area and depth is limited and prevents a larger attenuated volume.

The remaining service yard is constrained for HGV circulation and by existing utilities, so the attenuation tank size is restricted. Potentially high groundwater prevents the use of an infiltration/attenuation pond and a Defender is proposed to remove pollutants, given it serves only roof water.

This site specific Flood Risk Assessment shows that the site will be safe for its lifetime without increasing flood risk elsewhere, and in fact providing betterment.

The proposal complies with the National Planning Policy Framework.

Appendix – Drainage calculations by Paul Southcott.



Causeway

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Paul Southcott

CIVIL ENGINEERING SERVICES

File: staverton.pfd

Network: Storm Network

Paul Southcott

07/11/2025

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STAVERTON FACTORY

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Inverts
M5-60 (mm)	20.300	Minimum Backdrop Height (m)	0.200
Ratio-R	0.380	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Adoptable Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
374	1200	749	1500
499	1350	900	1800

>900 Link+900 mm

Max Depth (m)	Diameter (mm)	Max Depth (m)	Diameter (mm)
1.500	1050	99.999	1200

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	205438.520	67330.100	32.200	0.900	600				
						0	1-2	31.300	225
2	205500.050	67322.700	32.100	1.170	900		1	1-2	30.930
						0	2-3	30.930	225
3	205527.610	67338.490	31.850	1.110	600		1	2-3	30.740
						0	3-4	30.740	225
4	205547.690	67349.910	32.000	1.400	1800		1	8-4	30.600
						2	3-4	30.600	225
						0	4-5	30.600	225
6	205443.380	67371.360	32.100	0.860	600				
						0	6-7	31.240	225
7	205505.380	67363.850	32.000	1.130	900		1	6-7	30.870
						0	7-8	30.870	225
8	205525.650	67356.830	31.600	0.860	900		1	7-8	30.740
						0	8-4	30.740	225

 Causeway	Paul Southcott CIVIL ENGINEERING SERVICES	File: staverton.pfd Network: Storm Network Paul Southcott 07/11/2025	Page 2 STAVERTON FACTORY
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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
5	205559.010	67356.260	31.800	1.700	1200	1	4-5	30.100	225

Simulation Settings

Rainfall Methodology FSR Rainfall Events Singular FSR Region England and Wales M5-60 (mm) 20.300 Ratio-R 0.380 Summer CV 0.750 Winter CV 0.840 Analysis Speed Normal Skip Steady State x	Drain Down Time (mins) 240 Additional Storage (m³/ha) 20.0 Starting Level (m) Check Discharge Rate(s) ✓ 1 year (l/s) 23.8 30 year (l/s) 56.6 100 year (l/s) 72.1 Check Discharge Volume ✓ 1 year 360 minute (m³) 30
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Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440
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Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	45	0	0
30	45	0	0
100	45	0	0

Pre-development Discharge Rate

Site Makeup Brownfield Brownfield Method MRM Contributing Area (ha) 0.279 PIMP (%) 90 CV 0.750	Time of Concentration (mins) 6.00 Betterment (%) 30 Q 1 year (l/s) 23.8 Q 30 year (l/s) 56.6 Q 100 year (l/s) 72.1
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Pre-development Discharge Volume

Site Makeup Brownfield Brownfield Method MRM Contributing Area (ha) 0.279 PIMP (%) 90	CV 0.750 Return Period (years) 1 Climate Change (%) 0 Storm Duration (mins) 360	Betterment (%) 30 PR 0.675 Runoff Volume (m³) 30
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Node 4 Online Hydro-Brake® Control

Flap Valve ✓ Replaces Downstream Link x Invert Level (m) 30.600 Design Depth (m) 0.800 Design Flow (l/s) 22.0	Objective (HE) Minimise upstream storage Sump Available ✓ Product Number CTL-SHE-0209-2200-0800-2200 Min Outlet Diameter (m) 0.225 Min Node Diameter (mm) 1500
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Node 4 Depth/Area Storage Structure

Base Inf Coefficient (m/hr) 0.00000 Side Inf Coefficient (m/hr) 0.00000	Safety Factor 2.0 Porosity 1.00	Invert Level (m) 30.600 Time to half empty (mins) 21
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 Causeway			Paul Southcott CIVIL ENGINEERING SERVICES			File: staverton.pfd Network: Storm Network Paul Southcott 07/11/2025			Page 3 STAVERTON FACTORY		
Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	110.0	110.0	0.400	110.0	124.9	0.800	110.0	139.7	0.810	0.0	139.7
Rainfall											
Event						Peak Intensity (mm/hr)	Average Intensity (mm/hr)				
1 year +45% CC 15 minute summer						158.563	44.868				
1 year +45% CC 15 minute winter						111.272	44.868				
1 year +45% CC 30 minute summer						104.317	29.518				
1 year +45% CC 30 minute winter						73.205	29.518				
1 year +45% CC 60 minute summer						71.418	18.874				
1 year +45% CC 60 minute winter						47.449	18.874				
1 year +45% CC 120 minute summer						44.784	11.835				
1 year +45% CC 120 minute winter						29.754	11.835				
1 year +45% CC 180 minute summer						34.848	8.968				
1 year +45% CC 180 minute winter						22.652	8.968				
1 year +45% CC 240 minute summer						27.844	7.358				
1 year +45% CC 240 minute winter						18.499	7.358				
1 year +45% CC 360 minute summer						21.425	5.513				
1 year +45% CC 360 minute winter						13.927	5.513				
1 year +45% CC 480 minute summer						16.989	4.490				
1 year +45% CC 480 minute winter						11.287	4.490				
1 year +45% CC 600 minute summer						13.996	3.828				
1 year +45% CC 600 minute winter						9.563	3.828				
1 year +45% CC 720 minute summer						12.540	3.361				
1 year +45% CC 720 minute winter						8.428	3.361				
1 year +45% CC 960 minute summer						10.395	2.737				
1 year +45% CC 960 minute winter						6.886	2.737				
1 year +45% CC 1440 minute summer						7.652	2.051				
1 year +45% CC 1440 minute winter						5.142	2.051				
2 year 15 minute summer						141.352	39.998				
2 year 15 minute winter						99.194	39.998				
2 year 30 minute summer						92.363	26.136				
2 year 30 minute winter						64.816	26.136				
2 year 60 minute summer						62.266	16.455				
2 year 60 minute winter						41.368	16.455				
2 year 120 minute summer						38.405	10.149				
2 year 120 minute winter						25.516	10.149				
2 year 180 minute summer						29.576	7.611				
2 year 180 minute winter						19.225	7.611				
2 year 240 minute summer						23.449	6.197				
2 year 240 minute winter						15.579	6.197				
2 year 360 minute summer						17.935	4.615				
2 year 360 minute winter						11.658	4.615				
2 year 480 minute summer						14.159	3.742				
2 year 480 minute winter						9.407	3.742				
2 year 600 minute summer						11.623	3.179				
2 year 600 minute winter						7.941	3.179				
2 year 720 minute summer						10.382	2.783				
2 year 720 minute winter						6.977	2.783				
2 year 960 minute summer						8.563	2.255				
2 year 960 minute winter						5.672	2.255				
2 year 1440 minute summer						6.255	1.676				
2 year 1440 minute winter						4.204	1.676				
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 Causeway	Paul Southcott CIVIL ENGINEERING SERVICES	File: staverton.pfd Network: Storm Network Paul Southcott 07/11/2025	Page 4 STAVERTON FACTORY																																																																																																																																																																																																																								
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<tr><td>30 year (first 5mm) 180 minute winter</td><td>9.193</td><td>1.667</td><td></td></tr> <tr><td>30 year (first 5mm) 240 minute summer</td><td>6.203</td><td>1.250</td><td></td></tr> <tr><td>30 year (first 5mm) 240 minute winter</td><td>6.656</td><td>1.250</td><td></td></tr> <tr><td>30 year (first 5mm) 360 minute summer</td><td>4.202</td><td>0.833</td><td></td></tr> <tr><td>30 year (first 5mm) 360 minute winter</td><td>4.676</td><td>0.833</td><td></td></tr> <tr><td>30 year (first 5mm) 480 minute summer</td><td>3.286</td><td>0.625</td><td></td></tr> <tr><td>30 year (first 5mm) 480 minute winter</td><td>3.566</td><td>0.625</td><td></td></tr> <tr><td>30 year (first 5mm) 600 minute summer</td><td>2.668</td><td>0.500</td><td></td></tr> <tr><td>30 year (first 5mm) 600 minute winter</td><td>2.848</td><td>0.500</td><td></td></tr> <tr><td>30 year (first 5mm) 720 minute summer</td><td>2.215</td><td>0.417</td><td></td></tr> <tr><td>30 year (first 5mm) 720 minute winter</td><td>2.333</td><td>0.417</td><td></td></tr> <tr><td>30 year (first 5mm) 960 minute summer</td><td>1.765</td><td>0.312</td><td></td></tr> <tr><td>30 year (first 5mm) 960 minute winter</td><td>1.851</td><td>0.312</td><td></td></tr> <tr><td>30 year (first 5mm) 1440 minute summer</td><td>1.237</td><td>0.208</td><td></td></tr> <tr><td>30 year (first 5mm) 1440 minute winter</td><td>1.299</td><td>0.208</td><td></td></tr> <tr><td>30 year +45% CC 15 minute summer</td><td>389.019</td><td>110.079</td><td></td></tr> <tr><td>30 year +45% CC 15 minute winter</td><td>272.996</td><td>110.079</td><td></td></tr> <tr><td>30 year +45% CC 30 minute summer</td><td>255.341</td><td>72.253</td><td></td></tr> <tr><td>30 year +45% CC 30 minute winter</td><td>179.187</td><td>72.253</td><td></td></tr> <tr><td>30 year +45% CC 60 minute summer</td><td>171.631</td><td>45.357</td><td></td></tr> <tr><td>30 year +45% CC 60 minute winter</td><td>114.028</td><td>45.357</td><td></td></tr> <tr><td>30 year +45% CC 120 minute summer</td><td>104.509</td><td>27.619</td><td></td></tr> <tr><td>30 year +45% CC 120 minute winter</td><td>69.433</td><td>27.619</td><td></td></tr> <tr><td>30 year +45% CC 180 minute summer</td><td>79.386</td><td>20.429</td><td></td></tr> <tr><td>30 year +45% CC 180 minute winter</td><td>51.603</td><td>20.429</td><td></td></tr> <tr><td>30 year +45% CC 240 minute summer</td><td>62.108</td><td>16.413</td><td></td></tr> <tr><td>30 year +45% CC 240 minute winter</td><td>41.263</td><td>16.413</td><td></td></tr> <tr><td>30 year +45% CC 360 minute summer</td><td>46.881</td><td>12.064</td><td></td></tr> <tr><td>30 year +45% CC 360 minute winter</td><td>30.474</td><td>12.064</td><td></td></tr> <tr><td>30 year +45% CC 480 minute summer</td><td>36.643</td><td>9.684</td><td></td></tr> <tr><td>30 year +45% CC 480 minute winter</td><td>24.345</td><td>9.684</td><td></td></tr> <tr><td>30 year +45% CC 600 minute summer</td><td>29.836</td><td>8.161</td><td></td></tr> <tr><td>30 year +45% CC 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</table>				Rainfall				Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)		30 year (first 5mm) 15 minute summer	87.342	20.000		30 year (first 5mm) 15 minute winter	100.719	20.000		30 year (first 5mm) 30 minute summer	47.737	10.000		30 year (first 5mm) 30 minute winter	52.321	10.000		30 year (first 5mm) 60 minute summer	24.399	5.000		30 year (first 5mm) 60 minute winter	30.843	5.000		30 year (first 5mm) 120 minute summer	11.962	2.500		30 year (first 5mm) 120 minute winter	14.362	2.500		30 year (first 5mm) 180 minute summer	7.622	1.667		30 year (first 5mm) 180 minute winter	9.193	1.667		30 year (first 5mm) 240 minute summer	6.203	1.250		30 year (first 5mm) 240 minute winter	6.656	1.250		30 year (first 5mm) 360 minute summer	4.202	0.833		30 year (first 5mm) 360 minute winter	4.676	0.833		30 year (first 5mm) 480 minute summer	3.286	0.625		30 year (first 5mm) 480 minute winter	3.566	0.625		30 year (first 5mm) 600 minute summer	2.668	0.500		30 year (first 5mm) 600 minute winter	2.848	0.500		30 year (first 5mm) 720 minute summer	2.215	0.417		30 year (first 5mm) 720 minute winter	2.333	0.417		30 year (first 5mm) 960 minute summer	1.765	0.312		30 year (first 5mm) 960 minute winter	1.851	0.312		30 year (first 5mm) 1440 minute summer	1.237	0.208		30 year (first 5mm) 1440 minute winter	1.299	0.208		30 year +45% CC 15 minute summer	389.019	110.079		30 year +45% CC 15 minute winter	272.996	110.079		30 year +45% CC 30 minute summer	255.341	72.253		30 year +45% CC 30 minute winter	179.187	72.253		30 year +45% CC 60 minute summer	171.631	45.357		30 year +45% CC 60 minute winter	114.028	45.357		30 year +45% CC 120 minute summer	104.509	27.619		30 year +45% CC 120 minute winter	69.433	27.619		30 year +45% CC 180 minute summer	79.386	20.429		30 year +45% CC 180 minute winter	51.603	20.429		30 year +45% CC 240 minute summer	62.108	16.413		30 year +45% CC 240 minute winter	41.263	16.413		30 year +45% CC 360 minute summer	46.881	12.064		30 year +45% CC 360 minute winter	30.474	12.064		30 year +45% CC 480 minute summer	36.643	9.684		30 year +45% CC 480 minute winter	24.345	9.684		30 year +45% CC 600 minute summer	29.836	8.161		30 year +45% CC 600 minute winter	20.386	8.161		30 year +45% CC 720 minute summer	26.467	7.093		30 year +45% CC 720 minute winter	17.787	7.093		30 year +45% CC 960 minute summer	21.579	5.682		30 year +45% CC 960 minute winter	14.295	5.682		30 year +45% CC 1440 minute summer	15.492	4.152		30 year +45% CC 1440 minute winter	10.411	4.152		100 year +45% CC 15 minute summer	504.857	142.857		100 year +45% CC 15 minute winter	354.285	142.857		100 year +45% CC 30 minute summer	334.279	94.589		100 year +45% CC 30 minute winter	234.581	94.589	
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100 year +45% CC 240 minute summer	80.821	21.359																																																															
100 year +45% CC 240 minute winter	53.695	21.359																																																															
100 year +45% CC 360 minute summer	60.659	15.610																																																															
100 year +45% CC 360 minute winter	39.430	15.610																																																															
100 year +45% CC 480 minute summer	47.206	12.475																																																															
100 year +45% CC 480 minute winter	31.363	12.475																																																															
100 year +45% CC 600 minute summer	38.300	10.476																																																															
100 year +45% CC 600 minute winter	26.169	10.476																																																															
100 year +45% CC 720 minute summer	33.873	9.078																																																															
100 year +45% CC 720 minute winter	22.765	9.078																																																															
100 year +45% CC 960 minute summer	27.481	7.236																																																															
100 year +45% CC 960 minute winter	18.204	7.236																																																															
100 year +45% CC 1440 minute summer	19.580	5.248																																																															
100 year +45% CC 1440 minute winter	13.159	5.248																																																															

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Results for 1 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%								
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	11	31.360	0.060	6.5	0.0593	0.0000	OK
15 minute winter	2	11	31.063	0.133	25.4	0.3004	0.0000	OK
15 minute winter	3	11	30.881	0.141	27.2	0.0704	0.0000	OK
60 minute winter	4	44	30.814	0.214	30.0	24.0410	0.0000	OK
15 minute winter	6	11	31.300	0.060	6.5	0.0614	0.0000	OK
15 minute winter	7	11	31.006	0.136	25.4	0.3149	0.0000	OK
15 minute winter	8	11	30.881	0.141	27.2	0.1293	0.0000	OK
60 minute winter	5	44	30.157	0.057	14.5	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1-2	2	6.3	0.389	0.156	1.0168	
15 minute winter	2	2-3	3	24.9	0.985	0.621	0.8035	
15 minute winter	3	3-4	4	27.2	1.473	0.675	0.5643	
60 minute winter	4	4-5	5	14.5	1.775	0.141	0.1059	42.0
15 minute winter	6	6-7	7	6.3	0.380	0.157	1.0457	
15 minute winter	7	7-8	8	24.9	0.972	0.618	0.5501	
15 minute winter	8	8-4	4	27.3	1.485	0.677	0.5613	



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STAVERTON FACTORY

Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	11	31.356	0.056	5.8	0.0561	0.0000	OK
15 minute winter	2	11	31.053	0.123	22.7	0.2786	0.0000	OK
15 minute winter	3	11	30.872	0.132	24.3	0.0659	0.0000	OK
60 minute winter	4	45	30.791	0.191	25.9	21.5389	0.0000	OK
15 minute winter	6	11	31.297	0.057	5.8	0.0581	0.0000	OK
15 minute winter	7	11	30.996	0.126	22.7	0.2918	0.0000	OK
15 minute winter	8	11	30.872	0.132	24.3	0.1210	0.0000	OK
60 minute winter	5	45	30.152	0.052	12.1	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1-2	2	5.6	0.381	0.140	0.9308	36.2
15 minute winter	2	2-3	3	22.2	0.956	0.554	0.7377	
15 minute winter	3	3-4	4	24.4	1.454	0.604	0.5037	
60 minute winter	4	4-5	5	12.1	1.692	0.118	0.0930	
15 minute winter	6	6-7	7	5.6	0.373	0.141	0.9568	
15 minute winter	7	7-8	8	22.2	0.944	0.551	0.5050	
15 minute winter	8	8-4	4	24.5	1.465	0.606	0.5012	



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STAVERTON FACTORY

Results for 30 year (first 5mm) Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	7	31.346	0.046	4.1	0.0461	0.0000	OK
15 minute winter	2	7	31.024	0.094	15.4	0.2115	0.0000	OK
15 minute winter	3	7	30.853	0.113	15.8	0.0565	0.0000	OK
15 minute winter	4	14	30.688	0.088	32.3	9.9493	0.0000	OK
15 minute winter	6	7	31.286	0.046	4.1	0.0476	0.0000	OK
15 minute winter	7	7	30.965	0.095	15.4	0.2212	0.0000	OK
15 minute winter	8	7	30.854	0.114	15.7	0.1039	0.0000	OK
15 minute winter	5	14	30.126	0.026	3.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1-2	2	3.8	0.359	0.094	0.6655	
15 minute winter	2	2-3	3	14.4	0.827	0.358	0.5654	
15 minute winter	3	3-4	4	16.2	1.496	0.401	0.2887	
15 minute winter	4	4-5	5	3.0	1.132	0.029	0.0339	11.4
15 minute winter	6	6-7	7	3.8	0.352	0.094	0.6840	
15 minute winter	7	7-8	8	14.3	0.819	0.355	0.3872	
15 minute winter	8	8-4	4	16.1	1.503	0.400	0.2874	



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STAVERTON FACTORY

Results for 30 year +45% CC Critical Storm Duration. Lowest mass balance: 99.61%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	12	31.550	0.250	15.9	0.2482	0.0000	SURCHARGED
15 minute winter	2	12	31.507	0.577	60.5	1.3031	0.0000	SURCHARGED
30 minute winter	3	22	31.170	0.430	47.0	0.2147	0.0000	SURCHARGED
60 minute winter	4	47	31.108	0.508	65.2	57.1217	0.0000	SURCHARGED
15 minute winter	6	12	31.445	0.205	15.9	0.2107	0.0000	OK
15 minute winter	7	12	31.404	0.534	60.9	1.2371	0.0000	SURCHARGED
30 minute winter	8	22	31.166	0.426	47.5	0.3896	0.0000	SURCHARGED
15 minute winter	5	20	30.170	0.070	22.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1-2	2	15.2	0.433	0.380	2.4647	105.8
15 minute winter	2	2-3	3	49.5	1.245	1.235	1.2632	
30 minute winter	3	3-4	4	46.5	1.339	1.153	0.9187	
60 minute winter	4	4-5	5	22.0	1.981	0.214	0.1441	
15 minute winter	6	6-7	7	14.9	0.432	0.373	2.4288	
15 minute winter	7	7-8	8	50.6	1.273	1.255	0.8531	
30 minute winter	8	8-4	4	47.0	1.355	1.165	0.9188	



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STAVERTON FACTORY

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.56%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	12	32.170	0.870	20.7	0.8645	0.0000	FLOOD RISK
15 minute winter	2	12	32.100	1.170	79.4	2.6440	0.0000	FLOOD RISK
15 minute winter	3	12	31.486	0.746	73.4	0.3721	0.0000	SURCHARGED
60 minute winter	4	51	31.326	0.726	83.2	81.6533	0.0000	SURCHARGED
15 minute winter	6	12	32.030	0.790	20.7	0.8113	0.0000	FLOOD RISK
15 minute winter	7	12	31.956	1.086	76.9	2.5179	0.0000	FLOOD RISK
15 minute winter	8	12	31.506	0.766	74.6	0.7011	0.0000	FLOOD RISK
30 minute summer	5	20	30.170	0.070	22.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1-2	2	17.8	0.449	0.446	2.4647	136.8
15 minute winter	2	2-3	3	66.5	1.673	1.659	1.2632	
15 minute winter	3	3-4	4	72.3	1.818	1.791	0.9187	
60 minute winter	4	4-5	5	22.0	1.981	0.214	0.1441	
15 minute winter	6	6-7	7	17.0	0.432	0.427	2.4838	
15 minute winter	7	7-8	8	67.6	1.700	1.676	0.8531	
15 minute winter	8	8-4	4	73.6	1.852	1.825	0.9188	

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