Section 2.2 Site Investigation Reports

2.2.1 Flood Risk Assessment

Land at Jupiter House, Horton Road, Colnbrook, Slough, SL3 0BB

Flood Risk Assessment & Drainage Strategy Report

for

Panattoni / PDC UK 7 Ltd

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Issued by: Burrows Graham Limited
Buckland House,
Dower Mews,
Berkhamsted, Herts
HP4 2BL

Tel: 01442 508402

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Prepared		Paul Graveney, Senior Engineer, BEng (Hons) CEng MICE	
Checked		Roque Menezes, Director, MEng CEng IStructE	
Approved		Roque Menezes, Director, MEng CEng IStructE	

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CONTENTS

1.0 EXECUTIVE SUMMARY

The development proposal is for the demolition of existing buildings and redevelopment of the site to provide a commercial building (Flexible uses within Class B2 and/or B8 of the Use Class Order (including ancillary office provision)), with associated enabling works, access, parking, landscaping and infrastructure at a site known as Land at Jupiter House, Horton Road, Colnbroook, Slough.

The site benefits from extant planning permission under planning reference P/09811/001, granted in April 2022. The extant permission provides a clear legal fallback, it has established that an intensified employment use is acceptable and is an important part of the sites baseline in the consideration of this planning application, especially given the de minimis difference in the quantum of development.

The extant planning permission delivers 7,320 sqm GEA of commercial floorspace over six smaller units, compared to the proposed development which seeks consent for a single unit of 7,331 sq m (GEA) of commercial floorspace. An updated planning application has been submitted in response to occupier demand for HQ and last mile distribution centres to the west of London, which are built to Grade A standards and high ESG credentials.

At present, based on market intelligence, there is a very limited supply of units between 50,000 – 100,000 sq ft and a greater supply of smaller units in the local market. Due to proximity to Heathrow Airport a number of potential occupiers have requirements location critical to the immediate area and which currently cannot be satisfied due to the lack of supply. This updated application submitted is in direct response to that need.

With specific reference to this report, the extant planning permission was also supported by a Flood Risk Assessment and drainage Strategy Report. This updated assessment demonstrates that the scheme remains acceptable from a flood risk and drainage perspective.

A review of the site topographical, GPR and CCTV survey indicates that the majority of the surface water drainage currently outfalls to a number of soakaways located within the external yard areas. There is also as area of roof drainage that passes into the foul water drainage network and downstream sewer.

In accordance with the National Planning Policy Framework and the Slough Borough Council (SBC) Strategic Flood Risk Assessment, this report has studied and assessed the flood risk to the site by all sources.

A review of the EA Flood Maps and Product 4 flood data indicates that the proposed building area is fully located within Flood Zone 1, i.e. land defined as having less than a 1 in 1000 (<0.1%) annual probability of flooding from of river or sea water in any year. The very southern boundary leading onto Horton Road is shown to be located in Flood Zone 3, i.e. land defined as having greater than a 1 in 100 (>1.0%) annual probability of flooding from of river or sea water in any year. The proposed building type is defined as 'less vulnerable' such that the development can be considered 'appropriate' in accordance with NPPF guidelines. As the building area is located within Flood Zone 1, the sequential and exception tests are not required by the local authority. Further to this, the site is considered to be at 'low risk' from all sources of flooding; tidal, fluvial, pluvial, sewer, groundwater and artificial sources.

The surface water drainage strategy as outlined below is to restrict the proposed flow rate to satisfy SBC Policy for Brownfield developments and to ensure that the flood risk to the site and surrounding catchment is not increased by the development. The Sustainable Drainage Systems (SuDS) hierarchy has been considered in the drainage strategy discussed in Section 5. The surface water runoff will be collected from the impermeable areas and directed via the underground network to two geocellular attenuation and infiltration tanks located beneath the eastern service yard area that will enable the water to permeate into the underlying ground where they are located suitably above the identified ground water levels. BRE 365 infiltration tests have been undertaken to confirm the infiltration rates and groundwater levels. Due to the presence of elevated ground water levels and the lower lying dock / car park levels, infiltration will not be possible to all areas. As such a connection will be made to the foul water sewer in Horton Road at a peak rate of 2l/s.

This overall approach aligns with the Slough Sustainable Drainage Systems (SuDS) policy and mimics the pre development scenario. SBC are aware within their local Strategic Flood Risk Assessment that elevated groundwater levels have the potential to inhibit infiltration as a full means of draining the development. A detailed Drainage layout with hydraulic calculations incorporating appropriate climate change allowances have been prepared to support this approach and can be found in the Appendices. Other SuDS in the form of permeable paving will also be incorporated into the layout.

There is no residual flood risk from the development site to the surrounding district due to the mimicking in storm water flow rates. The development does not therefore increase the risk of flooding to other adjacent neighbourhoods. Out of chamber or gully flooding for the extreme 100 year plus climate change event may occur within the development site and is classed as exceedance flows. Flood water from this event will be contained within the development site and directed away from the unit to the yard and parking areas.

Foul flows will be collected by a new gravity network and discharge to the existing Thames Water foul water sewer network in Horton Road via an existing connection.

2.0 DEVELOPMENT DETAILS

2.1 CONTEXT

This Flood Risk Assessment & Drainage Strategy report has been prepared by Burrows Graham Ltd. on behalf of Panattoni / PDC UK 7 Ltd to support the planning application for the demolition of two existing buildings and redevelopment of the site to provide a commercial building (Flexible uses within Class B2 and/or B8 of the Use Class Order (including ancillary office provision)), with associated enabling works, access, parking, landscaping and infrastructure at a site known as land at Jupiter House, Horton Road, Colnbrook, Slough.

2.2 LOCATION

Site Name:	Land at Jupiter House, Horton Road, Colnbrook, Slough, SL3 0BB.
Grid Reference:	503219 175707
Site Area:	1.29 Ha
Site Description:	The irregular plan shape of the site encompasses two existing warehouse buildings with office buildings, external parking, loading docks and turning areas on the south western periphery of Viscount Industrial Estate. The site is located approximately 1km to the west of Heathrow airport. The area is predominantly industrial led with existing units to the north, west and east. To the south beyond Horton Road are further industrial units and an area of land which is currently unmade, with Wraysbury Reservoir beyond. Access into the site is from Horton Road to the south. The site area measures 1.29 hectares and is located within the Slough Borough Council area. A review of the topographical information indicates the site to very flat at circa 20.20m AOD. The access road then falls down into Horton Road, holding a level of circa 19.50m AOD.

Figure 1: Site Location

3.0 PLANNING OBLIGATIONS

3.1 NATIONAL PLANNING POLICY FRAMEWORK (NPPF)

Local planning authorities are advised by the National Planning Policy Framework (NPPF 2021) to consult the Environment Agency (EA) and Lead Local Flood Authorities (LLFA) on all developments of an area greater than 1Ha and those that are at an increased risk of flooding.

This report has been prepared to assess the requirements of the NPPF in accordance with the current EA and LLFA policies and will primarily assess the following.

- Determining whether the site is likely to be affected by flooding and whether it would increase flood risk elsewhere.
- Assessing whether the proposed development is appropriate in the suggested location.
- Detailing any measures necessary to mitigate any flood risk identified, to ensure that the proposed development and occupants would be safe, and that flood risk would not be increased elsewhere.
- Determine the current surface water drainage regime and assess any potential increase in surface water runoff as a result of the proposed development.
- Discuss Sustainable Drainage Systems (SuDS) as an option for reducing surface water flood risk.
- Devise an appropriate surface water drainage strategy (including calculation where appropriate) to deal with any potential increase in surface water runoff and include for climate change.
- Include the appropriate climate change allowances for both fluvial and surface water runoff.
- Consider the recommendations of the Slough Borough Council Strategic Flood Risk Assessment (SFRA) and other local policies.

A review of the EA Flood Maps and Product 4 Flood data indicates that the proposed building area is fully located within Flood Zone 1, i.e. land defined as having less than a 1 in 1000 (<0.1%) annual probability of flooding from of river or sea water in any year. The very southern boundary leading onto Horton Road is shown to be located in Flood Zone 3, i.e. land defined as having greater than a 1 in 100 (>1.0%) annual probability of flooding from of river or sea water in any year. The proposed building use is defined as 'less vulnerable' such that the development can be considered 'appropriate' in accordance with NPPF guidelines. As the site is within Flood Zone 1, the sequential and exception tests are not required by the local authority.

3.2 STRATEGIC FLOOD RISK ASSESSMENT

The aim of a Strategic Flood Risk Assessment (SFRA) is to assess the risks in a particular area with regard to all types of flooding and to determine how much development is permitted in that area. It can assess this by looking at how drainage systems in the area should function and how risks in vulnerable areas can be reduced and/or mitigated. The NPPF states that regional planning bodies (RPB's) or local planning authorities should prepare SFRA's in consultation with the EA.

The SFRA provides a detailed understanding of flood risk across all areas and from all sources. It states that the sequential and exception tests must be provided where applicable and climate change must be taken into consideration over the lifespan of the development.

The full report, prepared in March 2021 can be obtained from the Slough Borough Council website with the main objectives below:

- Determine the variations in risk from all sources of flooding across the Borough;
- Prepare broad policies for the management of flood risk;
- Steer development towards areas of lowest flood risk, through application of the Sequential Test and, where necessary, the Exception Test;
- Consider opportunities to reduce flood risk to existing communities through better management of surface water, provision for conveyance and storage for flood water;
- Incorporate Sustainable Drainage Systems (SuDS) as a means of controlling the surface water runoff from the site.
- Identify the level of detail required for site-specific Flood Risk Assessments.

3.3 LOCAL FLOOD RISK MANAGEMENT STRATEGY

The aim of this document is to set out the council's approach to managing flood risk in the short and long term. Slough's Local Flood Risk Management Strategy was published in 2013. The primary aim of the document is to improve the understanding of flood risks within the Borough and provide a source of information which can be utilised to identify ways of managing flood risk. The second objective is to reduce the risk of flooding for people and businesses in the Borough, and put forward key actions to ensure this can be achieved.

3.4 SLOUGH SUSTAINABLE DRAINAGE

Slough Borough Council have prepared the Slough Flood Risk and Surface Water Drainage Planning Guidance with the aim of how SuDS can be integrated into the fabric of development starting at the planning stage and leading through the concept, outline and detailed design stages.

The main principles of the report along with details from the Slough Borough Council website for the integration of SuDS for Major developments are summarised below:

- Details of how runoff is collected from roofs, roads and other hard surfaces to keep water at or near the surface.
- Site control features shown with approximate volumes, flow control locations and details.
- Flow routes including low flow, overflow and exceeding routes.
- Confirmation of sub-catchments with location of flow controls.
- Confirm the destination of the "controlled flow of clean water" from the site using the SuDS hierarchal approach with infiltration to ground first, followed by watercourse or the surface water sewer.
- Existing brownfield sites to discharge at Greenfield rates unless can confirm this is not achievable.
- Detailed SuDS management train approach to be incorporated throughout the scheme with appropriate measures from prevention, source control through to site control.

- ➢ Exceedance flows beyond the 30-year event can be incorporated as long as the water is managed and does not flow off site or cause flood risk to the development building.
- ➢ Detailed plans and hydraulic calculations to be provided at planning stage.

4.0 FLOOD RISK REVIEW

The NPPF guidelines require the developer to assess the impact of the proposed development runoff on the downstream catchment in conjunction with assessing the risk of runoff from the surrounding area on the proposed development layout.

In the following sections the flood risk to the site from all sources will be assessed. As the site will restrict the surface water runoff there is no increased flood risk to the downstream network.

4.1 FLUVIAL & TIDAL FLOODING

The site is not located near the sea or a tidally influenced watercourse, therefore the risk of tidal flooding is deemed to be very low.

The closest identified watercourse is the Wraysbury River located approximately 300m to the east, flowing in a southerly direction in parallel to the M25 motorway before outfalls to the River Thames approximately 4km downstream.

The National Planning Policy Framework (NPPF) categorises fluvial and tidal flood risk as follows:

- ➢ Zone 1 (low probability) – Land assessed as having less than a 1 in 1,000 annual probability of river or sea flooding (<0.1%);
- ➢ Zone 2 (medium probability) – Land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year; and
- ➢ Zone 3a (high probability) - Land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
- ➢ Zone 3b The Functional Floodplain - This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the EA. (Not separately distinguished from Zone 3a on the Flood Map).

Figure 2 below locates the site on the Environment Agency's (EA) indicative floodplain map. A review of the EA Flood Maps shows that the proposed building area is fully located within Flood Zone 1, i.e. land defined as having less than a 1 in 1000 (<0.1%) annual probability of flooding from of river or sea water in any year. The very southern boundary leading onto Horton Road is shown to be located in Flood Zone 3, i.e. land defined as having greater than a 1 in 100 (>1.0%) annual probability of flooding from of river or sea water in any year.

This is due to the surcharging of the fluvially influenced Wraysbury River, located approximately 300m to the east. The risk from fluvial water therefore requires further consideration. Refer to Section 5 for details.

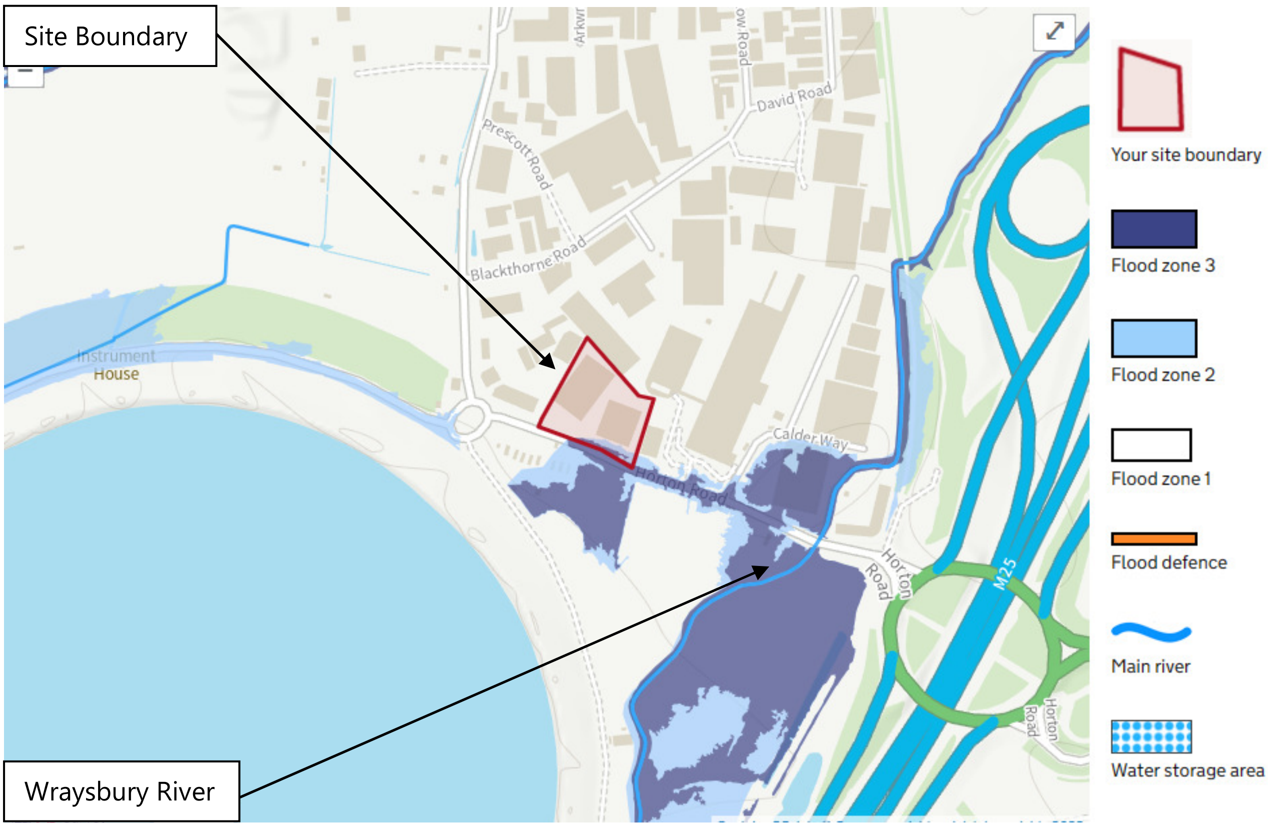

Figure 2: Extract from EA Fluvial Flood Risk Maps

4.2 SURFACE WATER FLOODING

The EA descriptions for the High, Medium and Low risk scenarios for surface water flooding are as follows:

- High risk means that each year this area has a chance of flooding of greater than 3.3%.
- Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%.
- Low risk means that each year this area has a chance of flooding of between 0.1% and 1%.
- Very Low risk means that each year this area has a chance of flooding of less than 0.1%.

A review of the EA surface water flood maps (Figure 3 below) indicates that the full site is classified as 'Very low risk'. There are no existing surface water flow routes through the site that would need to be maintained.

The development will mitigate against future surface water risk by removing the existing building & yard, and replacing with new building levels to suit the development intent. All new impermeable areas will be directed into a new underground drainage network designed in line with local and national guidance. Therefore, based on this assessment, the site can be considered at low risk from surface water flooding.

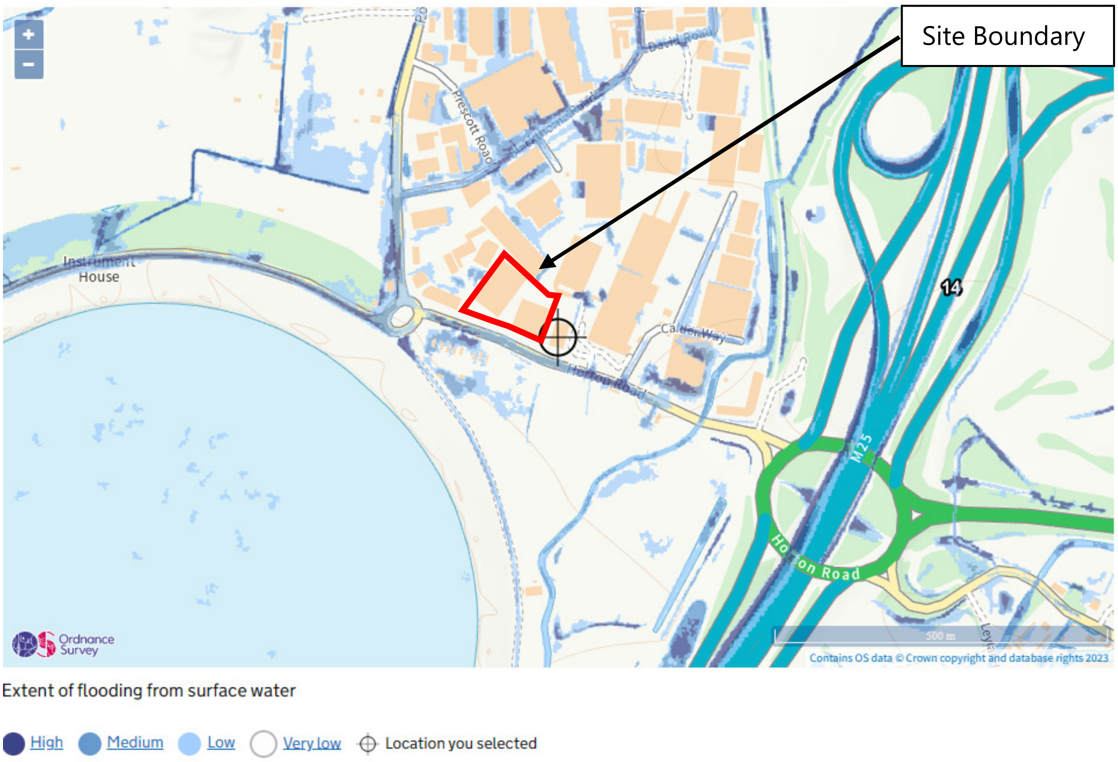

Figure 3: Extract from EA Surface Water Flood Risk Maps

4.3 GROUNDWATER FLOODING

Groundwater flooding occurs when the water table, the level of water below the ground, rises above the ground surface or into cellars and basements. Groundwater flooding is most likely to occur in low lying areas underlain by permeable rocks (aquifers). These may be extensive, regional aquifers, such as chalk or sandstone, or may be localised sands or river gravels in valley bottoms underlain by less permeable rocks.

According to the SFRA the presence of river gravel deposits means that there is potential for groundwater flooding in Slough. There are confirmed cases of groundwater flooding in the borough ranging from localised emergence affecting single properties to a number of larger events that have impacted at the settlement scale.

The proposed development does not include any below ground basement areas and the finished floor level is set approximately 1m above existing ground levels. Intrusive site investigations undertaken at the site have identified elevated ground water levels at circa 19.50m AOD. Based on this, the risk of groundwater flooding to the site is considered low.

4.4 SEWER FLOODING

The Thames Water (TW) sewer records have been reviewed and confirm that there are no surface water sewers in close proximately to the development site. Within Horton Road a 150mm diameter foul water public sewer exists flowing north westerly.

A CCTV and GPR survey of the current site has identified a network of foul water drains that outfall to the foul water sewer in Horton Road. Surface water runoff outfalls to existing on site soakaways.

These adopted foul water sewers and private drains are at the lowest part of the development and set down from the finished floor level of the proposed building. Furthermore, the extensive drainage network serving the surrounding urban district ensures that the development footprint is protected from the impact of both upstream and downstream runoff. It is speculated that complete protection may well exist beyond a storm event equivalent to the 30-year statistical event. Beyond this projection, there may be a small degree of peripheral 'Exceedance' flooding within the areas above the sewers. However, this is expected to be localised and restricted to the location of specific manhole covers located outside the development footprint. Thus, flood risk to the site from sewers is diminished to acceptable levels and considered to be low.

4.5 RESERVOIR FLOODING

Reservoir flooding is extremely unlikely to happen and there has been no loss of life in the UK from reservoir flooding since 1925. The Environment Agency is the enforcement authority and ensures that reservoirs are inspected regularly, and essential safety work is carried out.

The Long-Term Flood Risk Assessment (Flood Risk from Reservoirs) map shows the largest area that might be flooded if a reservoir were to fail and release the water it holds (see Figure 4). It can be seen from this map that the site is at from reservoir flooding to the close proximity of Wraysbury Reservoir.

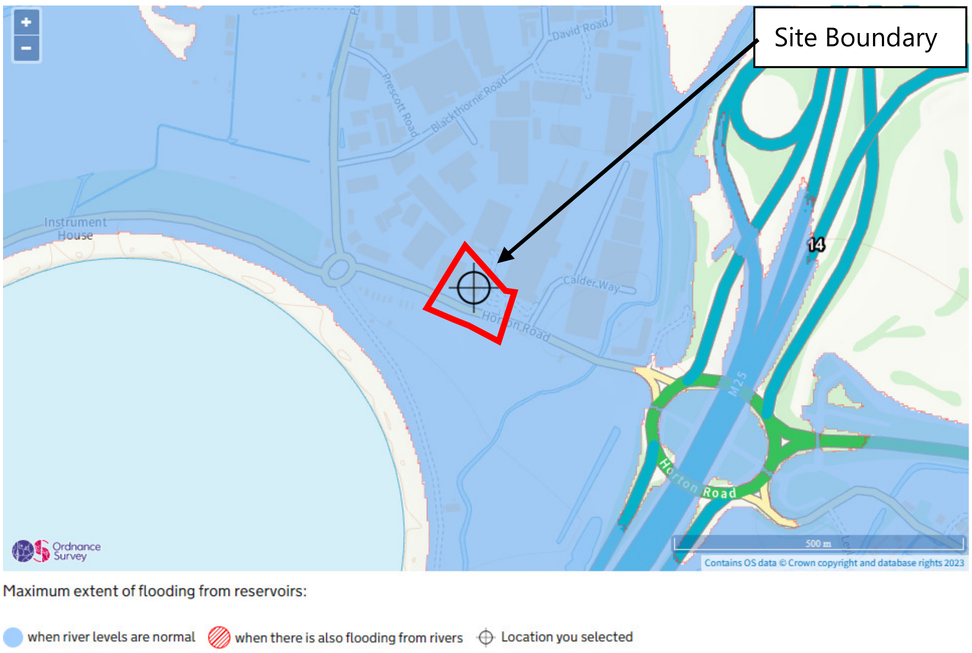

Figure 4: Extract from EA Reservoirs Water Flood Risk Maps

4.6 SUMMARY

Below is a table summary of the flood risks associated with the development site.

Source	Probability of Flood Risk	Impacts	Remarks
Tidal	Low	Low	The development building is not influenced by Tidal flood risk.
Fluvial (Watercourse)	Low - Medium	Low	The development building is located in low flood risk zone 1. The southern boundary onto Horton Road is located in high-risk flood zone 3. Further assessment required.
Surface Water (Overland Flood Flow)	Low	Low	The development is located within a Very Low Risk Zone. Future Drainage works to also remove risk.
Sewers & New Drainage	Low	Low	No adopted sewers within development boundary. New private drainage will serve the unit and external areas, all designed to current guidance with any exceedance flooding located away from the unit.
Groundwater	Low	Low	Development does not include basements, finished floor level elevated above ground water levels, and thus risk considered to be low.
Artificial Sources	Low – Medium	Low	Wraysbury Reservoir located along southern boundary. risk of breach extremely low.

Table 1: Flood Risk Summary Table

5.0 ASSESSMENT OF FLOOD RISK ON PROPOSED DEVELOPMENT

5.1 SUMMARY

As discussed in Section 3, the development site has been categorised in accordance with the SFRA and EA Flood Maps as being located predominantly in low-risk flood zone 1 but on the periphery of high-risk flood zone 3. This is related to flood risk from the Wraysbury River Thames to the east.

Other flood risk sources such as groundwater, sewer and overland flows have been considered and have been found not to be a flood risk generator to the site.

5.2 FLOODING FROM WRAYSBURY RIVER

Wraysbury River is located 300m to the east of the site and flows in a southerly direction in parallel with the M25 motorway before outfalling into the River Thames 4km downstream.

The EA have been consulted via a Product 4 flood data request and have confirmed that the indicative flood maps have been based on the Lower Colne Modelling and Mapping Study (2012). Table 2 below provides the various flood level data from this model at the nearest node point. Full details can be found in Appendix I.

Node Point	1 in 100 year (1% AEP)	1 in 100 year + 20% Climate Change (1% + 20%% CC AEP)	1 in 1000 year (0.1% AEP)
PB 112	19.84m AOD	19.91m AOD	20.02m AOD

Table 2: Peak Flood Levels of Wraysbury River

The central allowance peak climate change increase for a less vulnerable development with a design life of 60 years is 21% increase in river flows. This is only marginally above the 20% climate change allowance flood data provided by the EA.

The current finished floor level of the new building will be set at 21.20m AOD. This level is a minimum 1.18m higher than both the 1 in 100 year plus climate change and the 1 in 1000-year flood levels. This height is significantly above the suggested minimum 600mm freeboard increase and provides the required long term protection from flood risk.

The existing ground areas to the south of the site identified to be at high risk of flooding will remain unchanged, thus no flood storage compensation is required.

In light of these findings there is no flood risk to the proposed buildings or to the future occupiers.

6.0 DRAINAGE STRATEGY

6.1 CONSULTATION

At the time of writing, a response to a pre development enquiry is awaited from Thames Water. It would be expected that TW have no adverse comments as long as the SuDS hierarchy approach is followed.

6.2 EXISTING DRAINAGE

The site area currently encompasses existing buildings and hard paved areas which all positively drain to a number of soakaways located in the external yard and parking areas. There are a couple of rainwater pipes that connect to the private foul water drainage network that in turn outfalls to the TW foul water sewer in Horton Road. As such the site is considered to be predominantly greenfield for drainage purposes.

6.3 GEOLOGY

A detailed Phase 2 Site Investigation has been completed at the site. This has found the underlying ground to encompass depths of made ground over a mix of sands and gravels of the Shepperton Gravel Member over the London Clay formation at circa 4m depth. Ground water was identified within the boreholes at varying shallows depths.

In light of this the Geotechnical Consultant has advised that infiltration-based options would be possible based on the ground strata. Infiltration tests were completed and identified a rate of 5.40×10^{-5} m/s.

6.4 SUSTAINABLE DRAINAGE ASSESSMENT

Sustainable Drainage Systems (SuDS) are utilised in line with the CIRIA 753 guidance and Slough Policy with the aim to minimise the development's impact on the runoff quantity and quality and maximise amenity and biodiversity opportunities.

The CIRIA 753 Management train approach is a fundamental principle of SuDS systems, it aims to primarily reduce pollution, flow rates and volume of runoff from the site. The main objective is to treat the runoff as close to the source as possible and it is imperative that at least two of the following should be included within the drainage strategy.

- **Prevention** – The use of good site design and rainwater re-use measures to prevent runoff.
- **Source Control** – Controlling the runoff as close to source as possible by using green roofs, porous pavements and soakaways.
- **Site Control** – Use of water management techniques within local area, i.e. detention basins and geocellular storage.
- **Regional Control** – Management of water from a number of sites in a specific location, ie. balancing ponds and wetlands.

Table 3 below provides an assessment of various above and below ground SuDS methods that can provide water quality treatment and management of flows to reduce runoff rates and volumes and whether they can be suitably incorporated at this development site. The purpose of this assessment is to set out options to be considered at the planning stage with consideration to time constraints, viability and lifetime maintenance of the Leisure and commercial led development.

Method	Comment	Suitability	Suitability for Development
Green Roofs	• Can be used on suitable low-rise buildings to provide retention, attenuation and treatment of rainwater, and promotes evaporation and local biodiversity.	*Not Suitable:*	• Green roofs are better suited to be installed on flat roof areas. Given the building roof is pitched this will reduce the effectiveness of the system retaining water runoff. • Additional loading from a green roof on a large span structure will significantly increase structural and foundation design, which is not considered a sustainable approach particularly when considering reducing carbon footprint. • Roof is being installed with PVs so there will be limited room to incorporate significant areas of green roofs that will provide any additional SUDS benefit. • The standard main roof has a 25-year envelope warranty, which will be compromised by having a green roof. This will raise concern from future occupiers.
Rainwater Harvesting	• Rainwater harvesting reduces the total runoff volume from the developed site and reduces treated water consumption.	*Not Suitable:*	• Additional costs of installation would have severe effect on viability of the development. • Limited end use with small office area. • The ability to restrict peak flow rates and short-term peak volumes is non-existent where a critical storm event occurs.
Infiltration Options	• Reduces total run off volume from the development.	*Suitable:*	• Intrusive investigations would indicate that the underlying sands and gravels would be suitable for infiltration-based options.
Permeable Surfacing (Infiltration)	• Reduces total run off volume from the development. • Can be used to enhance water quality.	*Suitable:*	• Intrusive investigations would indicate that the underlying sands and gravels would be suitable for infiltration-based options.
Permeable Surfacing & Filter Drainage (Standard)	• Can be used to enhance quality of runoff water. • Sub-base provides 'source' storage and reduces the volume of storage downstream. • The storage can be created with selection of the stone fill or use of plastic box stems.	*Suitable:*	• Intrusive investigations would indicate that the underlying sands and gravels would be suitable for infiltration-based options. • Permeable surfacing utilised for the parking areas with filter drain beneath.

Swales, basins and ponds	• Provide areas for above ground runoff storage. • Allow filtering of particulate matter, improving water quality	*Not suitable:*	• No available area for attenuation pond or other green SuDS to be allocated.
Bio-Retention	• Collect and retain run-off to help improve water quality, prior to discharge in piped system on infiltration.	*Not suitable:*	• Site space constraints do not permit large above ground areas for flood storage. • No scope to reduce development area due to site viability.
Geocellular Storage	• Suitable for sites with insufficient space for basins etc. • Suitable for sites where topography prevents the use of open basins etc. • Can be very effective infiltration devices subject to ground conditions.	*Suitable:*	• Incorporated into the main design to act as the means of both attenuation and infiltration.

Table 3: SuDS Viability & Assessment

Based on the SuDS assessment in Table 3, plus an assessment of the local site conditions, the SuDS hierarchal approach for discharge of surface water at the development site is considered in greater detail below:

Method	Suitability	Suitability for Development
Infiltration to Ground	Yes	The underlying sand and gravel geology means infiltration is a suitable means of draining the majority of the site, in areas located above the identified groundwater levels.
Connection to Watercourse	No	Wraysbury River located to the east of the site at a higher ground level.
Connection to Surface Water Sewer	No	No surface water sewer in close proximity.
Connection to a Foul / Combined Sewer	Yes	Due to the presence of high groundwater levels, infiltration will not be feasible to all areas and thus a connection to the foul sewer will also be required at reduced flow rates.

Table 4: SuDS Hierarchal Approach

The SuDS strategy for this development will incorporate source control methods in the form permeable paving to the parking areas & access road, and site control in the form of a two geocellular infiltration / attenuation tanks to retain the peak flows prior to the water infiltrating to the underlying sands and gravels for the northern tank and outfalling to the foul sewer at a peak rate of 2l/s for the southern tank.

Whilst it would be beneficially to include more of these techniques, the space on site means it is not viable to include any additional above ground 'Green' SuDS measures.

6.5 CLIMATE CHANGE

In May 2022, the Environment Agency released updated climate change allowances for peak rainfall intensities which should be applied to new developments. Rather than nation wide allowances, each area will have its own peak rainfall allowances. In the case of the site, this is the Colne Management Catchment peak rainfall allowances.

Based on the nature of the development, a lifespan of 50 years is anticipated. Therefore, the potential climate change allowance for the 2070's ranges between 25% for the central allowance and 40% for the upper end allowance. In line with the EA Guidance for this design life, a central end allowance of 25% for climate change on peak rainfall intensity would be applicable and used to assess the peak discharge rates. However, to satisfy SBC guidance, the 40% climate change allowance has also been simulated in the hydraulic model for the 1 in 100-year residual risk event to confirm that exceedance flows can be safely retained in the site.

6.6 SURFACE WATER STRATEGY

Surface water generated from the roof of the new buildings will merge with the runoff from the new yards, and direct it into the underlying sands and gravels via two underground geocellular infiltration / attenuation tanks. The northern tanks will be sized based on an infiltration rate of 5.4×10^{-5}m/s (0.5m/hr). The base levels of the larger southern tank would be in directly above the identified groundwater levels. Therefore a controlled outflow of 1.5l/s would be required to the foul sewer. The car parking areas will also drain via the permeable surfacing to the foul sewer of 0.5l/s, thus a total peak offsite flow rate of 2l/s.

Full details of this strategy can be found on the BGL drawing in Appendix C and the hydraulic calculations in Appendix D.

The proposed private drainage layout for the new development site will be designed in accordance with BS EN 752: 2008 and Building Regulations part H guidance, i.e. to show no flooding to the 30-year storm return period criterion.

Events exceeding this up to and including the 100 year plus climate change allowance have been assessed. Flooding from these events is classed as exceedance flooding. The hydraulic model has found a small volume of exceedance flooding that will be retained in the lower lying dock area for both the 100 year + 25% and 40% climate change events.

The Slough Borough Council SuDS Drainage Assessment Form has been completed in support of the planning application and can be found in Appendix G.

6.7 WATER QUALITY, QUANTITY, AMENITY & BIODIVERSITY

Water quality has been considered and the following measures have been included within the surface water drainage proposals:

- Runoff from roofs is considered to be clean and will be discharged directly into the surface water network.
- All drainage from the car parking and access road areas have a medium risk and will pass through the permeable surfacing.
- The yard areas, which are considered at higher risk, will pass through a Class 1 full retention separator.
- Silt will be prevented from entering the system by the use of channels with silt traps and catch pits where required.
- As detailed under Section 6.5 - Surface Water Strategy, the reduction of water quantity has been considered by reducing site discharge and providing attenuation to control the runoff rates and peak volumes to the underlying sands and gravels.
- In terms of Amenity and Biodiversity, as discussed and justified in the Section 6.4 - Sustainable Drainage, there are limited areas on this fully developed site to form green SuDS infrastructure to provide amenity and biodiversity areas linked to the drainage strategy. Notwithstanding, reference should be made to the landscape drawings and the Ecology & Biodiversity report which details improvements being made in relation to this provision to the existing fully brownfield site.

6.8 FOUL WATER STRATEGY

Foul flows will discharge to the adjacent Thames Water foul water sewer network located to the south of the site in Horton Road via an existing connection. The site will drain by a private gravity network to this drain and be designed in line with Building Regulations Guidance. Refer to Appendix C for the outline foul water drainage plan.

7.0 MANAGEMENT, MAINTENANCE AND RISK

A private management company will maintain the drainage infrastructure as part of the site wide management and maintenance strategy, detailed in Appendix F. Typically, the maintenance regime will be in line with the table on the drainage strategy drawing.

Should exceedance flooding occur, access and egress to the development shall be from the main site access onto Horton Road to the south west.

The use of SuDS in the form of Source Control and site control measures will help to minimise the flood risk impact to the surrounding sewer network.

Up to and including the 100-year plus increase in rainfall allowance due to climate change (CC) event, the report has justified that there is no risk of flooding to the building or occupiers.

Flood risk to people and property can be managed but it can never be completely removed; a residual risk remains after flood management or mitigation measures have been put in place. This relates to a rainfall event beyond what can be fully quantified.

8.0 CONCLUSION

In conclusion, this report has studied and assessed the flood risk to the site by all sources with the proposals complying with national, regional and local planning policy & guidance. A review of the EA Flood Maps and Product 4 flood data indicates that the new building is located within Flood Zone 1, i.e. land defined as having less than a 1 in 1000 annual probability of flooding from river or sea water in any year with the southern periphery in Flood Zone 3, i.e. land defined as having greater than a 1 in 100 annual probability of flooding from river or sea water in any year. The proposed FFL at 21.20m AOD is located circa 1.18m above the peak flood water level in Horton Road and thus poses no risk.

Further to this, the report has found the site to be at 'low risk' from all sources of flooding; tidal, fluvial, pluvial, sewer, groundwater and artificial sources.

The surface drainage strategy is to mimic the pre development scenario of allowing the water to permeate into the underlying sands and gravels where the groundwater levels allow. The Sustainable Drainage Systems (SuDS) hierarchy has been considered in the drainage strategy with permeable surfacing and underground geocellular infiltration tanks located beneath the service yard. The existing site is fully impermeable and so the proposed strategy provides a like for lie scenario with no increase in post development discharge rates. The development does not therefore increase the risk of flooding to other adjacent neighbourhoods.

Foul flows will discharge to the adjacent Thames Water foul water sewer network located to the south of the site in Horton Road via an existing connection.

APPENDIX A – SITE MASTERPLAN

Site Layout
Scale 1:500

- Dimensions are in millimeters, unless stated otherwise.
- Scaling of this drawing is not recommended.
- It is the recipients responsibility to print this document to the correct scale.
- All relevant drawings and specifications should be read in conjunction with this drawing.

N

Schedule of Accommodation

Total GIA	-	**77,030 ft²**	**(7,156 m²)**
Total GEA	-	**78,908 ft²**	**(7,331 m²)**
Site Area	-	3.17 acres	1.28 ha
Site Density GIA	-		55.82%
Site Density GEA	-		57.18%
Unit 100			
Warehouse Area	-	67,941 ft²	(6,312 m²)
Office Area (incl. GF core)	-	9,089 ft²	(844 m²)
Unit 100 GIA	-	**77,030 ft²**	**(7,156 m²)**
Unit 100 GEA	-	**78,908 ft²**	**(7,331 m²)**

Planning Application Boundary

rev	amendments	by	ckd	date
P3	Issued for Planning	SW	LK	06.04.23

Horton Road, Poyle, London

Coloured Site Plan

Information Container LOD:	LOD 350

PLANNING

THIS DRAWING IS TO BE USED FOR THE STATED PURPOSE ONLY AND SHOULD NOT BE USED FOR ANY OTHER

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umc architects

Newark Beacon, Cafferata Way, Newark, Nottinghamshire NG24 2TN
o. +44 (0)1636 653027 e. info@umcarchitects.com

RIBA PoW Stage:	2 - Concept Design
Document Suitability:	S3
Drawn / Checked:	SW / LK
Date:	23/03/2023
Scale:	1:500 A1
UMC Project Number:	22400

Document Reference:	Drawing no:	Revision:
22400 - UMC - ZZZZ - SI - DR - A	0611	P3

10m SCALE 1:500

APPENDIX B – TOPOGRAPHICAL & GPR SURVEYS

Station Information:

Station	Easting (m)	Northing (m)	Level (m)
GH1	503154.453	175669.701	19.500
GH2	503216.885	175646.870	19.533
R1	503144.648	175672.623	19.495
X	503218.878	175646.196	19.570

N

OS Note:

Some services may have been omitted due to parked vehicles. The Ordnance Survey tile is to be used as a guide only.

OS Buildings | *Surveyed Buildings*

This survey has been orientated to the Ordnance Survey (O.S) National Grid OSGB36(15) via Global Navigation Satellite Systems (GNSS) and the O.S. Active Network (OS Net).

A true OSGB36 coordinate has been established near to the site centre via a transformation using the OSTN15GB & OSGM15GB transformation models.

The survey has been correlated to this point and a further one or more OSGB36 (15) points established to create a true O.S. bearing for angle orientation.

No scale factor has been applied to the survey therefore the coordinates shown are arbitrary & not true O.S. Coordinates which have a scale factor applied.

Please refer to Survey Station Table to enable establishment of the on-site grid and datum.

Legend:

Buildings		Overhead Cable		IC	Inspection chamber	Bo	Bollard
Wall		Concrete edge		PInv	Pipe invert	IB	Illuminated bollard
Kerb line		Tarmac edge		Gy	Gully	Bin	Rubbish bin
Line marking		Grass verge		Bg	Back gully	Vp	Vent pipe
Drop kerb		Canopy/Overhang		Dp	Down pipe	Grl	Ground light
Centre line		Verge		Pipe	Pipe above ground	Lbox	Letter box
Top of bank		Bottom of bank		MH	Manhole	Stmp	Tree Stump
1		Station and Name		WL	Water level	Sty	Stile
100.000		Station Level		Fl	Flood light	IFL	Internal floor level
				Lp	Lamp post	THL	Threshold level
Bush, Sap		Tree / Bush / Sapling		Tp	Telegraph post	Sp	Sign post
		Area of Undergrowth		Ep	Electricity post	TH	Trialhole
		Woodland		Tl	Traffic light	BH	Borehole
				Bus	Bus stop	ELC	Electric
R:		Ridge Level		Sv	Stop valve	BT	British Telecom
E:		Eaves Level		St	Stop tap	C'box	Control box
F:		Flat Roof Level		Er	Earth rod	TT	Tactile
		Gate		Wm	Water meter	BP	Brick paved
Fence types:				Gas	Gas valve	CPS	Concrete paving slabs
I\W		Interwoven		Av	Air valve	CVR	Cover
I\R		Iron Railings		ICU	Unidentified inspection	R/wall	Retaining wall
W\M		Wire Mesh		Wo	Wash out	TWL	Top of Wall Level
P\R		Post & Rail		Re	Rodding eye	TCL	Tree canopy level
P\W		Post & Wire		BB	Belisha beacon	G:	Girth
C\L		Chain Link		CTV	Cable tv	MG	Multi girth
W\P		Wooden Panels		Mkr	Marker post	IC	Inspection chamber
C\B		Close Boarded		Gmkr	Gas marker post	CL:	Cover level
S\P		Steel Palisade		So	Soffit	IL:	Invert level
				Fh	Fire hydrant	UTL	Unable to lift

Rev	Date	Description	Drawn	Q. Ref.
1	21.02.23	Additional boundary levels	SS	GH16129

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Topographical Surveys | Measured Building Surveys
Site Engineering | 3D Laser Scanning
Utility / CCTV Surveys | Revit & BIM Models

Rowan House
Duffield Road
Little Eaton
Derby
DE21 5DR
Tel (01332) 830044 Fax (01332) 830055
admin@greenhatch-group.co.uk
www.greenhatch-group.co.uk

St Albans
Unit B, The Courtyard
Alban Park
St Albans
Hertfordshire
AL4 0LA
t. (01727) 854481

Newcastle
24 Riverside Studios
Amethyst Road
Newcastle Bus. Park
Newcastle-U-Tyne
NE4 7YL
t. (01912) 736391

London
27, Cornwall Terrace Mews
Regents Park
London
NW1 5LL
t. (02072) 241806

CLIENT

Burrows Graham

PROJECT

Horton Road
Slough
SL3 OAT

TITLE

Topographical Survey

SCALE	DATE
A2@ 1: 500	**21.02.20**
DRAWN	QUALITY REF
SS	**GH6963**

Level datum: See note
Grid orientation: See note

Job number: 36010

Drawing No.: 36010_T — Rev.: 1

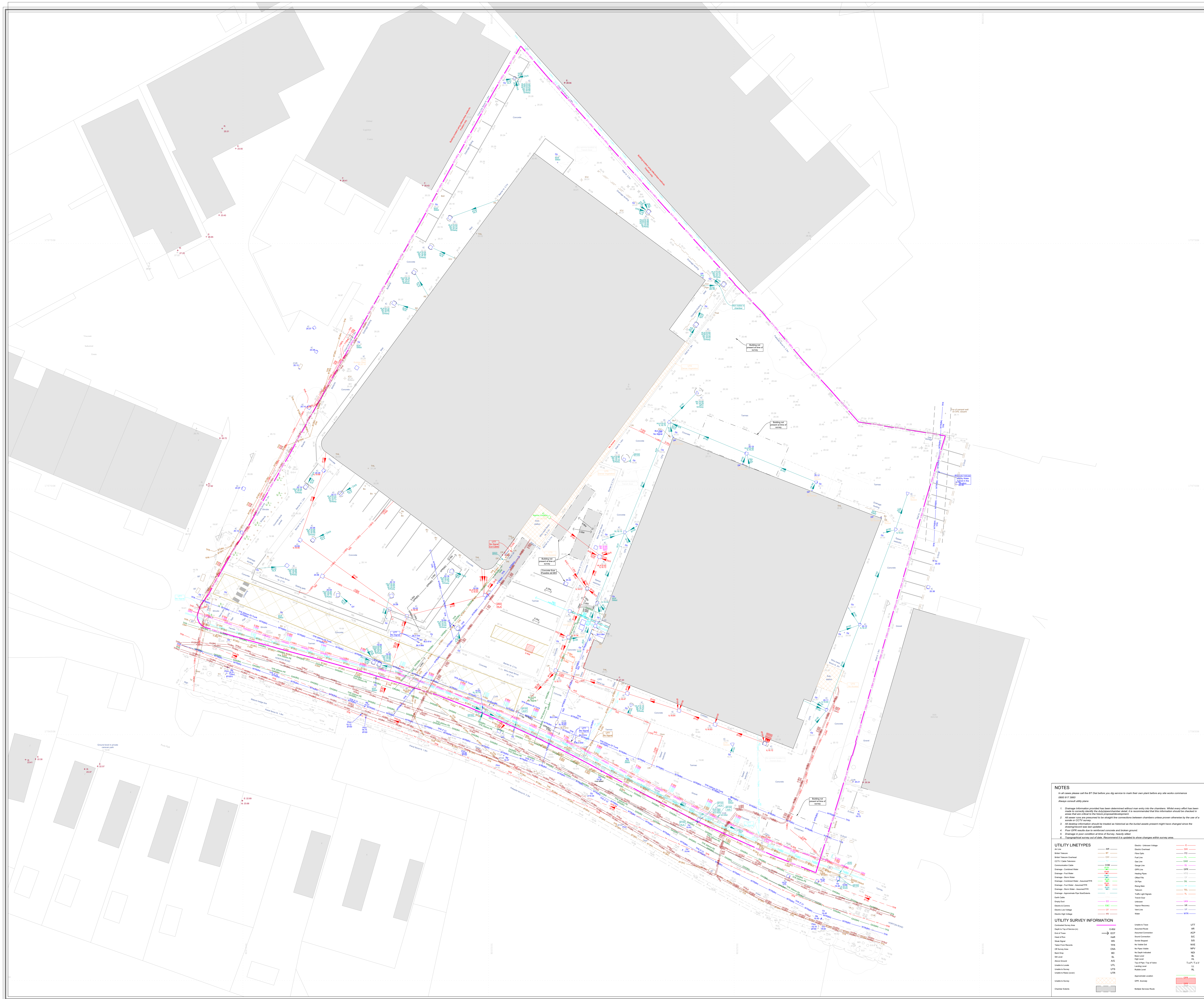
Comments

This plan should only be used for its original purpose. Greenhatch Group accepts no responsibility for this plan if supplied to any party other than the original client.

All dimensions should be checked on site prior to design and construction.

Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only.

Notes:



NOTES

In all cases please call the BT Dial before you dig service to mark their own plant before any site works commence

0800 917 3993

Always consult utility plans

1. *Drainage Information provided has been determined without man entry into the chambers. Whilst every effort has been made to correctly identify the duty/pipes/chamber detail, it is recommended that this information should be checked in areas that are critical to the future proposal/development.*
2. *All sewer runs are presumed to be straight line connections between chambers unless proven otherwise by the use of a sonde or CCTV survey.*
3. *All desktop information should be treated as historical as the buried assets present might have changed since the drawing/record was last updated.*
4. *Poor GPR results due to reinforced concrete and broken ground.*
5. *Drainage in poor condition at time of Survey, heavily silted.*
6. *Topographical survey out of date. Recommend it is updated to show changes within survey area.*

UTILITY LINETYPES

UTILITY SURVEY INFORMATION

LEGEND

PAS 128 : 2022 LEVEL B SURVEY

QUALITY LEVEL	CRITERIA USED IN THE DETERMINATION OF QUALITY LEVEL	LOCATION ACCURACY
QL-B4	A UTILITY SEGMENT WHICH IS SUSPECTED TO EXIST (EITHER ON QL-D OR QL-C) BUT HAS NOT BEEN DETECTED AND THEREFORE SHOWN AS AN ASSUMED ROUTE. **(NO DETECTION POSSIBLE)**	**UNDEFINED**
QL-B3/B3P	HORIZONTAL LOCATION ONLY OF THE UTILITY DETECTED BY ONE OF THE GEOPHYSICAL TECHNIQUES USED. **(EML OR GPR DETECTION WITH LIMITED CONFIDENCE IN DEPTH)**	**+/- 500mm HORIZONTAL LOCATE. UNDEFINED VERTICAL LOCATE**
QL-B2/B2P	HORIZONTAL & VERTICAL LOCATION OF THE UTILITY DETECTED BY ONE OF THE GEOPHYSICAL TECHNIQUES. **(EML OR GPR DETECTION WITH CONFIDENCE IN DEPTH)**	**+/- 250mm HORIZONTAL LOCATE +/- 40% VERTICAL LOCATE**
QL-B1/B1P	POSITION AND DEPTH OF THE UTILITY DETECTED BY MULTIPLE GEOPHYSICAL TECHNIQUES. **(EML + GPR DETECTION)**	**+/- 150mm HORIZONTAL LOCATE +/- 15% VERTICAL LOCATE**

DISCLAIMER

Whilst every effort has been taken in the preparation of this drawing, the original land marks/apparatus configuration may have been altered since the survey/drawing was produced. The user shall make further enquiries and investigations to satisfy himself as to the accuracy of this drawing and position of the apparatus. The exact positions of the apparatus should be verified by the use of suitable detection devices and safe digging practices in accordance with HSG47, further advice on the location of apparatus should be recommended by the owner. No representation is made by Greenhatch Group, its agents or servants as to the accuracy, completeness, and sufficiency or otherwise of this drawing and the position of the apparatus.

All apparatus shall be treated as live unless proved otherwise by the owner. It is the users responsibility to ensure that the information on the location of apparatus is provided to all persons (either direct labour or contractors) working in proximity to the apparatus.

Rev	Date	Description	Drawn	Q. Ref

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Rowan House
Duffield Road
Little Eaton
Derby
DE21 5DR
Tel (01332) 830044 Fax (01332) 830055
admin@greenhatch-group.co.uk
www.greenhatch-group.co.uk

St Albans: Unit B, The Courtyard, Alban Park, St Albans, Hertfordshire, AL4 0LA, t. (01727) 854481
Newcastle: 24 Riverside Studios, Amethyst Road, Newcastle Bus. Park, Newcastle-U-Tyne, NE4 7YL, t. (01912) 736391
London: 27, Cornwall Terrace Mews, Regents Park, London, NW1 5LL, t. (02072) 241806

CLIENT
Baynham Meikle

PROJECT
Horton Road
Slough
SL3 OAT

TITLE
Utility
Survey

SCALE	DATE
A2@ 1: 500	09.02.2023
DRAWN	**QUALITY REF**
JB	GH16142

Level datum: See note
Grid orientation: See note
Job number: 36010
Drawing No.: 36010_UG
Rev.: 0

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All dimensions should be checked on site prior to design and construction.
Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only.

Notes:

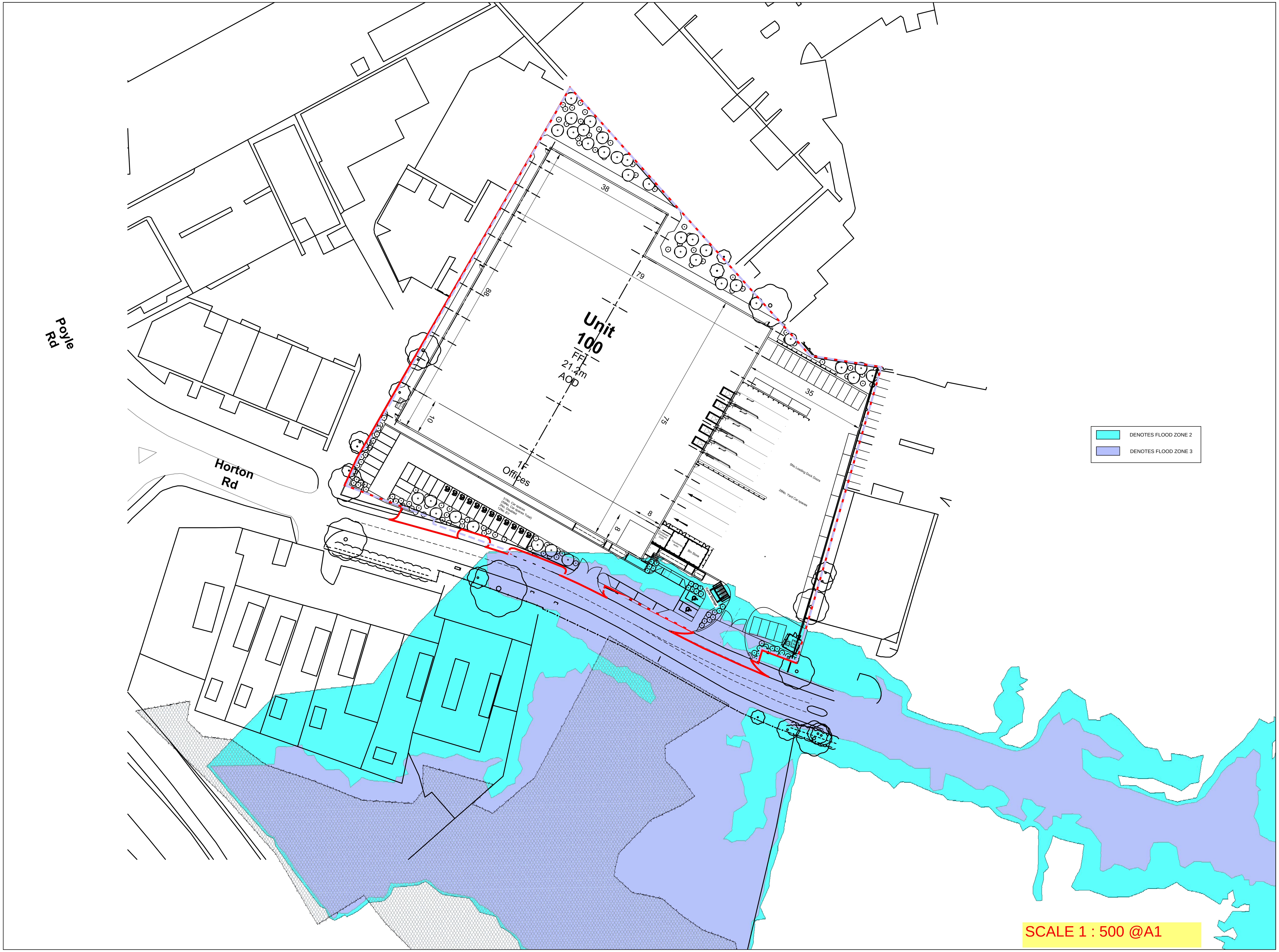
UTILITY LINETYPES

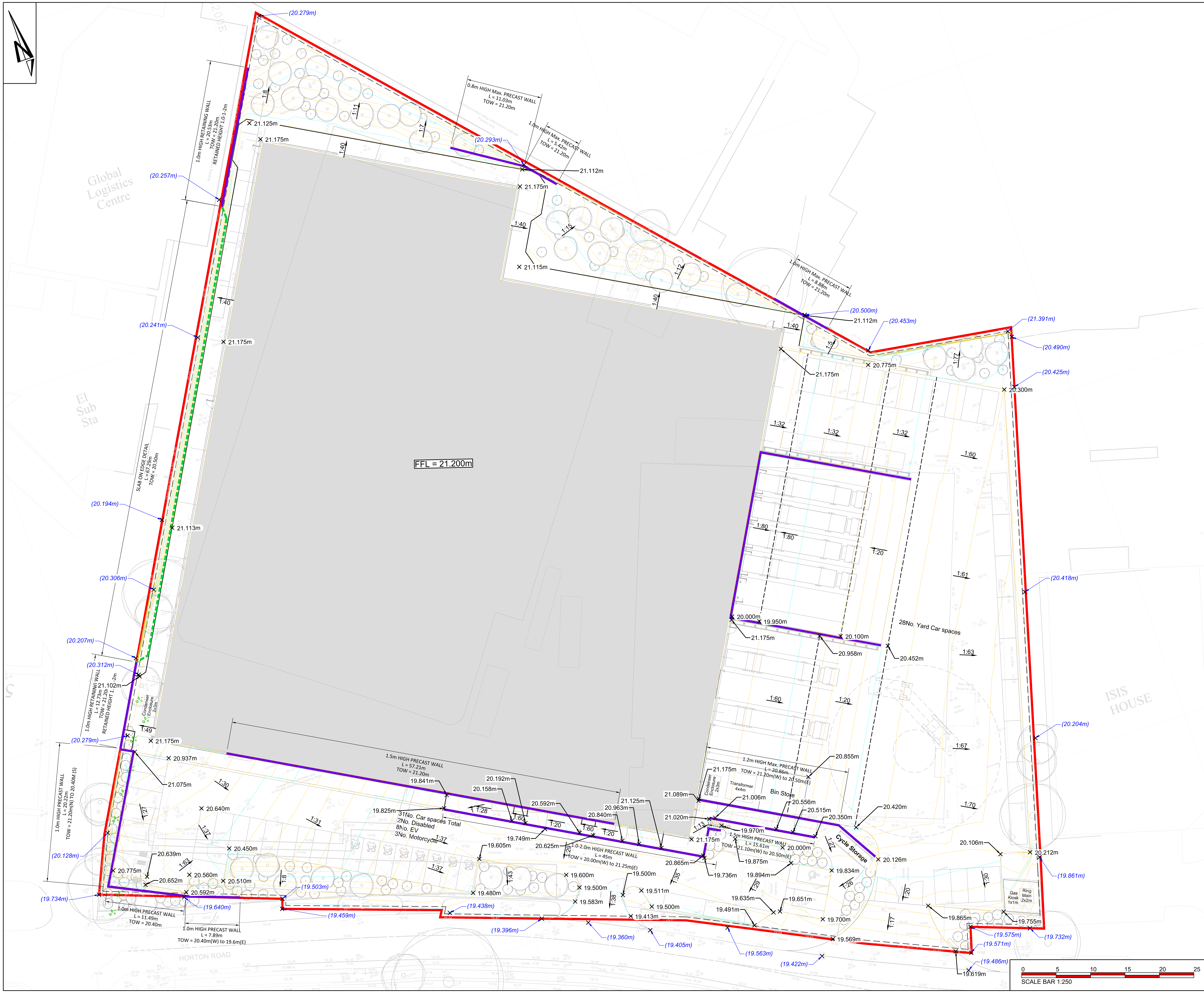
Air Line	AIR
British Telecom	BT
British Telecom Overhead	O/H
CCTV / Cable Television	TV
Communication Cable	COM
Drainage - Combined Water	Ø150
Drainage - Foul Water	Ø150
Drainage - Storm Water	Ø150
Drainage - Combined Water - Assumed/TFR	Ø150
Drainage - Foul Water - Assumed/TFR	Ø150
Drainage - Storm Water - Assumed/TFR	Ø150
Drainage - Approximate Pipe Size/Extents	
Earth Cable	ETH
Empty Duct	ED
Electric & Comms	E&C
Electric Low Voltage	LV
Electric High Voltage	HV
Electric - Unknown Voltage	E
Electric Overhead	O/H
Fibre Optic	FO
Fuel Line	FL
Gas Line	GAS
Gauge Line	GL
GPR Line	GPR
Heating Pipes	HTG
Offset Fills	OF
Oil Pipe	OIL
Rising Main	>>
Telecom	TEL
Traffic Light Signals	TL
Trench Scar	
Unknown	UKN
Vapour Recovery	VR
Vent Line	VP
Water	WTR

UTILITY SURVEY INFORMATION

Contracted Survey Area	SVY AREA
Depth to Top of Service (m)	0.40d
End of Trace	EOT
Head of Run	HoR
Weak Signal	WS
Taken From Records	TFR
Off Survey Area	OSA
Back Drop	BD
Silt Level	SL
Above Ground	A/G
Unable to Locate	UTL
Unable to Survey	UTS
Unable to Raise (cover)	UTR
Unable to Survey	
Chamber Extents	
Unable to Trace	UTT
Assumed Route	AR
Assumed Connection	ACP
Sound Connection	S/C
Sonde Stopped	S/S
No Visible Exit	NVE
No Pipes Visible	NPV
No Depth Indicated	NDI
Base Level	BL
High Level	HL
Top of Pipe / Top of Valve	T.o.P / T.o.V
Landing Level	LL
Rubble Level	RL
Approximate Location	
GPR Anomaly	
Multiple Services Route	

APPENDIX C – BGL DRAWINGS


Poyle Rd
Horton Rd
Unit 100
FFL 21.4m AOD
1F Offices
38
79
88
10
75
35
8
8
5No Loading Dock Doors
28No. Yard Car spaces
31No. Car spaces
(59No. Car spaces Total)
2No. Disabled
12No. EV
DENOTES FLOOD ZONE 2
DENOTES FLOOD ZONE 3
SCALE 1 : 500 @A1



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IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION
1. ADD RESIDUAL RISKS HERE

MAINTENANCE
1. ADD RESIDUAL RISKS HERE

DEMOLITION
1. ADD RESIDUAL RISKS HERE

IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT

GENERAL NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL THE RELEVANT ARCHITECTS, ENGINEERS' AND SERVICE ENGINEERS DRAWINGS & SPECIFICATIONS.
2. BASED ON GREENHATCH GROUP TOPO SURVEY GH6963 (21/02/2020) AND UMC ARCHITECTS LAYOUT 22400-UMC-ZZZZ-SI-DR-A-601 REV P05.

REV	DATE	BY	DESCRIPTION	CHK'D
P02	15/03/23	DRD	SITE LAYOUT UPDATED	DB
P01	12/01/23	DRD	FIRST ISSUE	RM

Burrows Graham

North Office:
5 Ambassador Place, Stockport Road,
Altrincham WA15 8DB
Tel: +44 (0)161 804 8046

South Office:
Buckland House, Dower Mews,
High Street, Berkhamsted HP4 2BL
Tel: +44 (0)1442 508 402

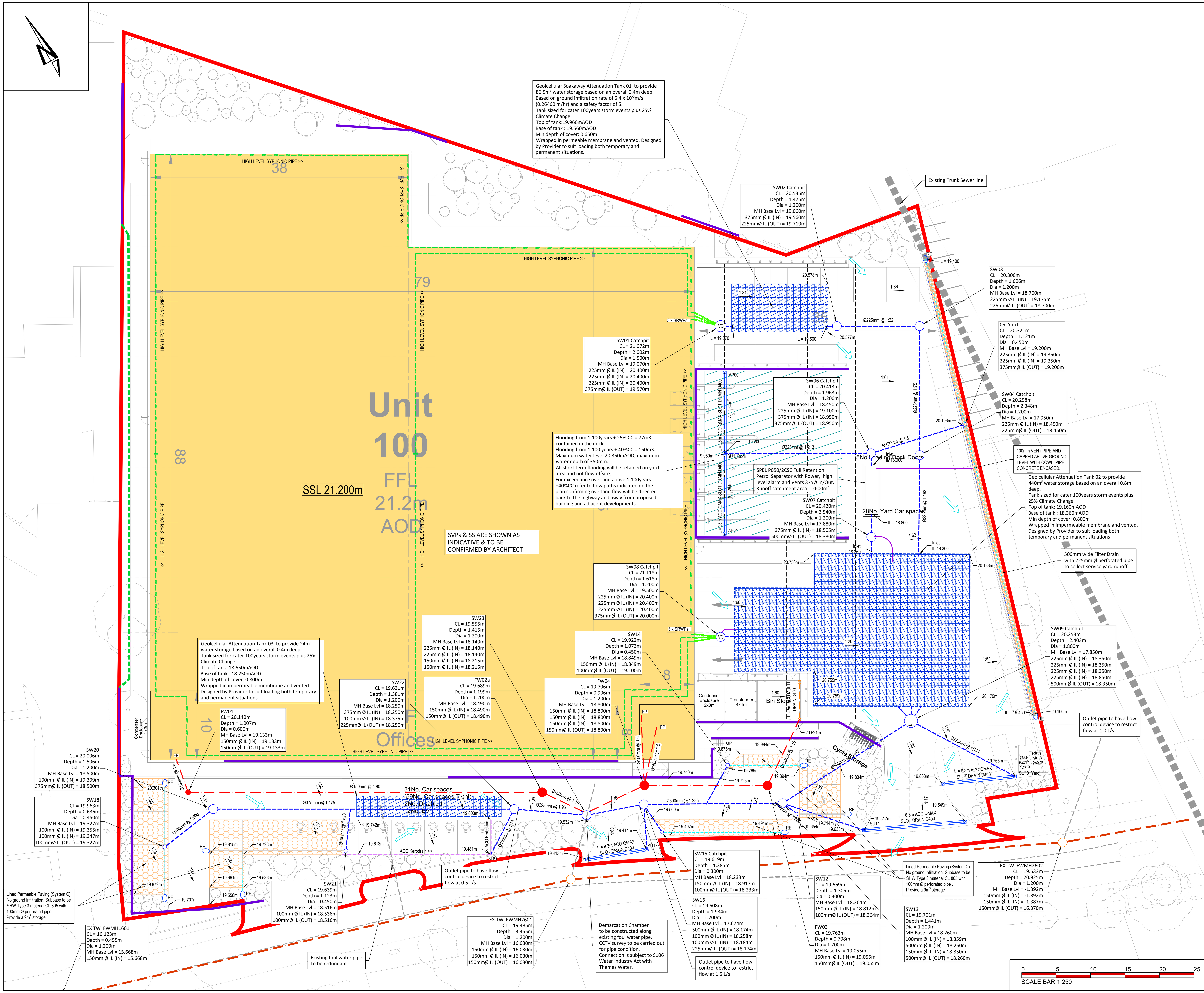
CLIENT
PANATTONI

PROJECT
HORTON ROAD, POYLE

DRAWING TITLE
PROPOSED LEVELS

OUR PROJECT NUMBER	DRAWING STATUS	OFFICE	
22232	PRELIMINARY	SOUTH	
SCALE @ A1	DATE	DRAWN BY	CHECKED BY
1:250 @A1	12/01/23	DRD	RM

DRAWING No	REV
22232-BGL-XX-XX-DR-C-00200	P02



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CONSTRUCTION
1. ADD RESIDUAL RISKS HERE

MAINTENANCE
1. ADD RESIDUAL RISKS HERE

DEMOLITION
1. ADD RESIDUAL RISKS HERE

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GENERAL NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL THE RELEVANT ARCHITECTS, ENGINEERS' AND SERVICE ENGINEERS DRAWINGS & SPECIFICATIONS.
2. BASED ON GREENHATCH GROUP TOPO SURVEY GH6963 (21/02/2020) AND UMC ARCHITECTS LAYOUT 22400-UMC-ZZZZ-SI-DR-A-601 REV P05.
3. Average ground water level based on the SI is 19.50m AOD

KEY:

- Site Boundary
- S.S.L. ??.??m — Proposed Building Level
- SWMH — Proposed Surface Water pipe & Chamber
- FWMH — Proposed Foul Water pipe & Chamber
- Existing Foul Water Pipe
- Proposed Syphonic Pipe
- SU — Proposed Slot Drain & Sump Unit
- Proposed Foul Water Channel
- Proposed Kerb Drain
- KDG — Proposed Kerb Drain Gully
- Proposed Attenuation Tank
- Proposed porous paving block
- Filter Drain with Perforated Pipe
- 1:40 — Proposed yard slope
- RE — Rodding Eye
- FP — Foul Water Pops Up
- BD — Backdrop
- TG — Trapped Bin Gully
- Exceedance Flow Arrow
- Public Sewer Lines
- EX_MH — Existing Foul Water pipe & Chamber

REV	DATE	BY	DESCRIPTION	CHK'D
P01	04.04.23	SN	First Issue	RM

Burrows Graham

North Office:
5 Ambassador Place, Stockport Road,
Altrincham WA15 8DB
Tel: +44 (0)161 804 8046

South Office:
Buckland House, Dower Mews,
High Street, Berkhamsted HP4 2BL
Tel: +44 (0)1442 508 402

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PROJECT
HORTON ROAD, POYLE

DRAWING TITLE
PROPOSED DRAINAGE PLAN

OUR PROJECT NUMBER	DRAWING STATUS	OFFICE	
22232	PRELIMINARY	SOUTH	
SCALE @ A1	DATE	DRAWN BY	CHECKED BY
1:250 @A1	24/03/23	SN	RM

DRAWING No: 22232-BGL-XX-XX-DR-C-00210
REV: P01

APPENDIX D – BGL HYDRAULIC CALCULATIONS

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 Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.000
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Width (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.295	5.00	21.122	1500		503259.134	175710.558	1.252
J1			20.610			503273.387	175702.666	1.050
3			20.364	1200		503285.857	175695.666	1.664
4			20.298	1200		503276.614	175679.366	1.798
SU4_Dock	0.055	5.00	19.950	700	700	503252.129	175693.560	0.750
SU5_Yard	0.220	5.00	20.198	700	700	503284.033	175680.129	0.998
6			20.416	1350		503270.626	175683.070	1.466
7			20.359	1500		503268.887	175672.725	1.979
8	0.358	5.00	21.138	1350		503237.393	175671.124	1.138
09			20.363	2100		503256.714	175648.543	2.013
SU_Entr	0.014	5.00	19.517	400	400	503242.735	175635.988	0.517
SU11	0.010	5.00	19.765	700	700	503265.646	175631.953	1.225
13			19.766	2100		503235.855	175645.843	1.506
15	0.036	5.00	19.608	1200		503216.809	175655.058	1.408
23			19.617	1200		503210.032	175659.036	1.477
18	0.008	5.00	20.658	450		503153.203	175683.937	1.100
21	0.037	5.00	20.056	450		503158.144	175680.564	1.100
17	0.040	5.00	20.661	1200		503162.121	175685.196	2.161
22			19.631	1200		503200.043	175663.716	1.381
EX_TW			19.485	1200		503202.245	175650.866	1.457

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	J1	16.292	0.600	19.870	19.560	0.310	52.6	375	5.11	50.0
1.001	J1	3	14.300	0.600	19.710	19.175	0.535	26.7	225	5.20	50.0
1.002	3	4	18.738	0.600	18.700	18.575	0.125	149.9	225	5.50	50.0
1.003	4	7	10.189	0.600	18.500	18.458	0.042	242.6	300	5.66	50.0
2.000	SU4_Dock	6	21.265	0.600	19.200	19.100	0.100	212.6	225	5.40	50.0
3.000	SU5_Yard	6	13.726	0.600	19.200	19.000	0.200	68.6	375	5.10	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	2.504	276.5	40.0	0.877	0.675	0.295	0.0	96	1.801
1.001	2.540	101.0	40.0	0.675	0.964	0.295	0.0	98	2.393
1.002	1.065	42.4	40.0	1.439	1.498	0.295	0.0	174	1.207
1.003	1.005	71.0	40.0	1.498	1.601	0.295	0.0	161	1.034
2.000	0.893	35.5	7.5	0.525	1.091	0.055	0.0	70	0.710
3.000	2.189	241.8	29.8	0.623	1.041	0.220	0.0	88	1.506

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
2.001	6	7	10.490	0.600	18.950	18.655	0.295	35.6	375	5.45	50.0
1.004	7	09	27.073	0.600	18.380	18.360	0.020	1353.7	525	6.42	50.0
4.000	8	09	29.719	0.600	20.000	19.270	0.730	40.7	375	5.17	50.0
6.000	SU_Entr	13	12.019	0.600	19.000	18.850	0.150	80.1	225	5.14	50.0
5.000	SU11	09	18.842	0.600	18.540	18.429	0.111	169.7	225	5.31	50.0
1.005	09	13	21.033	0.600	18.350	18.260	0.090	233.7	500	6.66	50.0
1.006	13	15	21.158	0.600	18.260	18.200	0.060	352.6	500	6.97	50.0
1.007	15	23	7.858	0.600	18.260	18.140	0.120	65.5	225	7.05	50.0
7.000	18	17	9.006	0.600	19.558	19.406	0.152	59.3	100	5.15	50.0
8.000	21	17	6.105	0.600	18.956	18.850	0.106	57.6	100	5.10	50.0
7.001	17	22	43.583	0.600	18.500	18.250	0.250	174.3	450	5.62	50.0
7.002	22	23	11.031	0.600	18.250	18.140	0.110	100.3	150	5.81	50.0
1.008	23	EX_TW	11.287	0.600	18.140	18.028	0.112	100.8	150	7.24	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
2.001	3.047	336.5	37.3	1.091	1.329	0.275	0.0	84	2.038
1.004	0.600	129.9	77.2	1.454	1.478	0.570	0.0	292	0.625
4.000	2.847	314.4	48.5	0.763	0.718	0.358	0.0	99	2.082
6.000	1.462	58.1	1.9	0.292	0.691	0.014	0.0	28	0.674
5.000	1.000	39.8	1.4	1.000	1.709	0.010	0.0	29	0.469
1.005	1.416	278.1	127.1	1.513	1.006	0.938	0.0	237	1.385
1.006	1.151	226.0	129.0	1.006	0.908	0.952	0.0	271	1.187
1.007	1.618	64.3	133.9	1.123	1.252	0.988	0.0	225	1.648
7.000	1.002	7.9	1.1	1.000	1.155	0.008	0.0	25	0.706
8.000	1.017	8.0	5.0	1.000	1.711	0.037	0.0	57	1.073
7.001	1.536	244.4	11.5	1.711	0.931	0.085	0.0	65	0.799
7.002	1.003	17.7	11.5	1.231	1.327	0.085	0.0	88	1.067
1.008	1.001	17.7	145.4	1.327	1.307	1.073	0.0	150	1.019

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	16.292	52.6	375	Circular	21.122	19.870	0.877	20.610	19.560	0.675
1.001	14.300	26.7	225	Circular	20.610	19.710	0.675	20.364	19.175	0.964
1.002	18.738	149.9	225	Circular	20.364	18.700	1.439	20.298	18.575	1.498
1.003	10.189	242.6	300	Circular	20.298	18.500	1.498	20.359	18.458	1.601
2.000	21.265	212.6	225	Circular	19.950	19.200	0.525	20.416	19.100	1.091
3.000	13.726	68.6	375	Circular	20.198	19.200	0.623	20.416	19.000	1.041
2.001	10.490	35.6	375	Circular	20.416	18.950	1.091	20.359	18.655	1.329

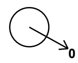
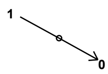
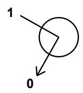
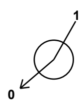
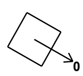
Link	US Node	Dia (mm)	Width (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1500		Manhole	Adoptable	J1		Junction	
1.001	J1			Junction		3	1200	Manhole	Adoptable
1.002	3	1200		Manhole	Adoptable	4	1200	Manhole	Adoptable
1.003	4	1200		Manhole	Adoptable	7	1500	Manhole	Adoptable
2.000	SU4_Dock	700	700	Manhole	Adoptable	6	1350	Manhole	Adoptable
3.000	SU5_Yard	700	700	Manhole	Adoptable	6	1350	Manhole	Adoptable
2.001	6	1350		Manhole	Adoptable	7	1500	Manhole	Adoptable

Pipeline Schedule

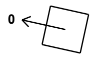
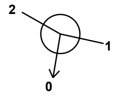
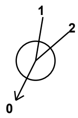
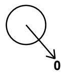
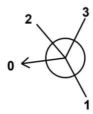
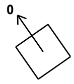
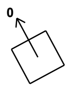
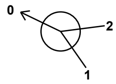
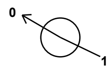
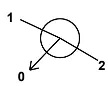
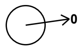
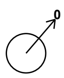
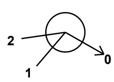
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.004	27.073	1353.7	525	Circular	20.359	18.380	1.454	20.363	18.360	1.478
4.000	29.719	40.7	375	Circular	21.138	20.000	0.763	20.363	19.270	0.718
6.000	12.019	80.1	225	Circular	19.517	19.000	0.292	19.766	18.850	0.691
5.000	18.842	169.7	225	Circular	19.765	18.540	1.000	20.363	18.429	1.709
1.005	21.033	233.7	500	Circular	20.363	18.350	1.513	19.766	18.260	1.006
1.006	21.158	352.6	500	Circular	19.766	18.260	1.006	19.608	18.200	0.908
1.007	7.858	65.5	225	Circular	19.608	18.260	1.123	19.617	18.140	1.252
7.000	9.006	59.3	100	Circular	20.658	19.558	1.000	20.661	19.406	1.155
8.000	6.105	57.6	100	Circular	20.056	18.956	1.000	20.661	18.850	1.711
7.001	43.583	174.3	450	Circular	20.661	18.500	1.711	19.631	18.250	0.931
7.002	11.031	100.3	150	Circular	19.631	18.250	1.231	19.617	18.140	1.327
1.008	11.287	100.8	150	Circular	19.617	18.140	1.327	19.485	18.028	1.307

Link	US Node	Dia (mm)	Width (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.004	7	1500		Manhole	Adoptable	09	2100	Manhole	Adoptable
4.000	8	1350		Manhole	Adoptable	09	2100	Manhole	Adoptable
6.000	SU_Entr	400	400	Manhole	Adoptable	13	2100	Manhole	Adoptable
5.000	SU11	700	700	Manhole	Adoptable	09	2100	Manhole	Adoptable
1.005	09	2100		Manhole	Adoptable	13	2100	Manhole	Adoptable
1.006	13	2100		Manhole	Adoptable	15	1200	Manhole	Adoptable
1.007	15	1200		Manhole	Adoptable	23	1200	Manhole	Adoptable
7.000	18	450		Manhole	Adoptable	17	1200	Manhole	Adoptable
8.000	21	450		Manhole	Adoptable	17	1200	Manhole	Adoptable
7.001	17	1200		Manhole	Adoptable	22	1200	Manhole	Adoptable
7.002	22	1200		Manhole	Adoptable	23	1200	Manhole	Adoptable
1.008	23	1200		Manhole	Adoptable	EX_TW	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections		Link	IL (m)	Dia (mm)
1	503259.134	175710.558	21.122	1.252	1500			0	1.000	19.870	375
J1	503273.387	175702.666	20.610	1.050				1	1.000	19.560	375
								0	1.001	19.710	225
3	503285.857	175695.666	20.364	1.664	1200			1	1.001	19.175	225
								0	1.002	18.700	225
4	503276.614	175679.366	20.298	1.798	1200			1	1.002	18.575	225
								0	1.003	18.500	300
SU4_Dock	503252.129	175693.560	19.950	0.750	700	700		0	2.000	19.200	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections		Link	IL (m)	Dia (mm)
SU5_Yard	503284.033	175680.129	20.198	0.998	700	700					
								0	3.000	19.200	375
6	503270.626	175683.070	20.416	1.466	1350			1	3.000	19.000	375
								2	2.000	19.100	225
								0	2.001	18.950	375
7	503268.887	175672.725	20.359	1.979	1500			1	2.001	18.655	375
								2	1.003	18.458	300
								0	1.004	18.380	525
8	503237.393	175671.124	21.138	1.138	1350						
								0	4.000	20.000	375
09	503256.714	175648.543	20.363	2.013	2100			1	5.000	18.429	225
								2	4.000	19.270	375
								3	1.004	18.360	525
								0	1.005	18.350	500
SU_Entr	503242.735	175635.988	19.517	0.517	400	400					
								0	6.000	19.000	225
SU11	503265.646	175631.953	19.765	1.225	700	700					
								0	5.000	18.540	225
13	503235.855	175645.843	19.766	1.506	2100			1	6.000	18.850	225
								2	1.005	18.260	500
								0	1.006	18.260	500
15	503216.809	175655.058	19.608	1.408	1200			1	1.006	18.200	500
								0	1.007	18.260	225
23	503210.032	175659.036	19.617	1.477	1200			1	7.002	18.140	150
								2	1.007	18.140	225
								0	1.008	18.140	150
18	503153.203	175683.937	20.658	1.100	450						
								0	7.000	19.558	100
21	503158.144	175680.564	20.056	1.100	450						
								0	8.000	18.956	100
17	503162.121	175685.196	20.661	2.161	1200			1	8.000	18.850	100
								2	7.000	19.406	100
								0	7.001	18.500	450

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections	Link	IL (m)	Dia (mm)
22	503200.043	175663.716	19.631	1.381	1200		1	7.001	18.250	450
							0	7.002	18.250	150
EX_TW	503202.245	175650.866	19.485	1.457	1200		1	1.008	18.028	150

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	20.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.400	Check Discharge Rate(s)	x
Summer CV	0.750	Check Discharge Volume	x
Analysis Speed	Normal		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	35	0	0
100	25	0	0

Node 09 Online Head/Flow Control

Flap Valve	x	Invert Level (m)	18.350	Design Flow (l/s)	1.0
Replaces Downstream Link	✓	Design Depth (m)	0.500		

Head (m)	Flow (l/s)
0.500	1.000

Node SU11 Online Orifice Control

Flap Valve	✓	Design Depth (m)	1.000	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	100.0		
Invert Level (m)	18.540	Diameter (m)	0.225		

Node 15 Online Orifice Control

Flap Valve	x	Design Depth (m)	1.000	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	1.3		
Invert Level (m)	18.260	Diameter (m)	0.025		

Node 22 Online Orifice Control

Flap Valve	x	Design Depth (m)	1.000	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	0.5		
Invert Level (m)	18.250	Diameter (m)	0.015		

Node SU_Entr Online Orifice Control

Flap Valve	✓	Design Depth (m)	0.225	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	35.0		
Invert Level (m)	19.000	Diameter (m)	0.223		

Node J1 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.26460	Invert Level (m)	19.560	Depth (m)	0.400
Side Inf Coefficient (m/hr)	0.26460	Time to half empty (mins)	15	Inf Depth (m)	
Safety Factor	5.0	Pit Width (m)	7.000	Number Required	1
Porosity	0.95	Pit Length (m)	13.000		

Node 09 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	18.350
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	550.0	0.0	0.800	550.0	0.0	0.801	0.0	0.0

Node 13 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	18.260
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	100.0	0.0	0.300	100.0	0.0	0.301	0.0	0.0

Node 18 Carpark Storage Structure

Base Inf Coefficient (m/hr)	1.33200	Invert Level (m)	19.558	Slope (1:X)	500.0
Side Inf Coefficient (m/hr)	1.33200	Time to half empty (mins)	0	Depth (m)	0.400
Safety Factor	5.0	Width (m)	5.000	Inf Depth (m)	
Porosity	0.30	Length (m)	16.800		

Node 21 Carpark Storage Structure

Base Inf Coefficient (m/hr)	1.33200	Invert Level (m)	18.956	Slope (1:X)	500.0
Side Inf Coefficient (m/hr)	1.33200	Time to half empty (mins)	0	Depth (m)	0.400
Safety Factor	5.0	Width (m)	5.000	Inf Depth (m)	
Porosity	0.30	Length (m)	29.000		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	109.521	30.991	1 year 480 minute summer	11.185	2.956
1 year 30 minute summer	71.439	20.215	1 year 600 minute summer	9.182	2.511
1 year 60 minute summer	48.435	12.800	1 year 720 minute summer	8.203	2.199
1 year 120 minute summer	30.053	7.942	1 year 960 minute summer	6.768	1.782
1 year 180 minute summer	23.233	5.979	1 year 1440 minute summer	4.949	1.326
1 year 240 minute summer	18.475	4.882	30 year +35% CC 15 minute summer	362.754	102.647
1 year 360 minute summer	14.169	3.646	30 year +35% CC 30 minute summer	236.154	66.823

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year +35% CC 60 minute summer	157.395	41.595	100 year +25% CC 30 minute summer	286.207	80.987
30 year +35% CC 120 minute summer	95.091	25.130	100 year +25% CC 60 minute summer	191.610	50.637
30 year +35% CC 180 minute summer	71.952	18.516	100 year +25% CC 120 minute summer	115.702	30.577
30 year +35% CC 240 minute summer	56.165	14.843	100 year +25% CC 180 minute summer	87.258	22.454
30 year +35% CC 360 minute summer	42.149	10.846	100 year +25% CC 240 minute summer	67.836	17.927
30 year +35% CC 480 minute summer	32.837	8.678	100 year +25% CC 360 minute summer	50.604	13.022
30 year +35% CC 600 minute summer	26.670	7.295	100 year +25% CC 480 minute summer	39.267	10.377
30 year +35% CC 720 minute summer	23.611	6.328	100 year +25% CC 600 minute summer	31.789	8.695
30 year +35% CC 960 minute summer	19.190	5.053	100 year +25% CC 720 minute summer	28.065	7.522
30 year +35% CC 1440 minute summer	13.717	3.676	100 year +25% CC 960 minute summer	22.707	5.979
100 year +25% CC 15 minute summer	435.923	123.351	100 year +25% CC 1440 minute summer	16.120	4.320

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	19.970	0.100	39.6	0.6449	0.0000	OK
60 minute summer	J1	39	19.759	0.199	26.7	17.2072	0.0000	OK
60 minute summer	3	40	18.778	0.078	10.2	0.0880	0.0000	OK
1440 minute summer	4	1440	18.605	0.105	0.8	0.1183	0.0000	OK
15 minute summer	SU4_Dock	10	19.270	0.070	7.4	0.1378	0.0000	OK
15 minute summer	SU5_Yard	10	19.294	0.094	29.5	0.4594	0.0000	OK
15 minute summer	6	10	19.040	0.090	36.3	0.1291	0.0000	OK
1440 minute summer	7	1440	18.605	0.225	2.9	0.3968	0.0000	OK
15 minute summer	8	10	20.102	0.102	48.0	0.7857	0.0000	OK
1440 minute summer	09	1440	18.605	0.255	6.6	133.8964	0.0000	OK
15 minute summer	SU_Entr	10	19.033	0.033	1.9	0.0228	0.0000	OK
15 minute summer	SU11	10	18.565	0.025	1.3	0.0164	0.0000	OK
1440 minute summer	13	930	18.404	0.144	0.4	4.8331	0.0000	OK
1440 minute summer	15	930	18.404	0.204	0.5	0.3357	0.0000	OK
600 minute summer	23	420	18.161	0.021	0.7	0.0238	0.0000	OK
15 minute summer	18	11	19.566	0.008	1.1	0.0239	0.0000	OK
15 minute summer	21	11	18.977	0.021	5.0	0.1870	0.0000	OK
180 minute summer	17	140	18.585	0.085	1.9	0.1283	0.0000	OK
120 minute summer	22	104	18.586	0.336	2.6	0.3795	0.0000	SURCHARGED
600 minute summer	EX_TW	420	18.049	0.021	0.7	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	J1	39.6	2.287	0.143	0.4528	
60 minute summer	J1	1.001	3	10.2	1.622	0.101	0.0898	
60 minute summer	J1	Infiltration		1.5				
60 minute summer	3	1.002	4	10.2	0.864	0.242	0.2219	
60 minute summer	4	1.003	7	10.2	0.698	0.144	0.1495	
15 minute summer	SU4_Dock	2.000	6	7.2	0.696	0.202	0.2196	
15 minute summer	SU5_Yard	3.000	6	29.2	1.431	0.121	0.2800	
15 minute summer	6	2.001	7	36.1	1.897	0.107	0.1999	
15 minute summer	7	1.004	09	36.0	0.733	0.278	1.3390	
15 minute summer	8	4.000	09	47.3	2.024	0.150	0.6940	
1440 minute summer	09	Head/Flow	13	0.4				
15 minute summer	SU_Entr	Orifice	13	1.9				
15 minute summer	SU11	Orifice	09	1.3				
15 minute summer	13	1.006	15	-4.4	-0.266	-0.019	0.5342	
1440 minute summer	15	Orifice	23	0.5				
600 minute summer	23	1.008	EX_TW	0.7	0.489	0.041	0.0167	23.9
15 minute summer	18	7.000	17	0.1	0.330	0.011	0.0024	
15 minute summer	18	Infiltration		0.9				
15 minute summer	21	8.000	17	0.7	0.625	0.092	0.0072	
15 minute summer	21	Infiltration		4.0				
15 minute summer	17	7.001	22	6.0	0.401	0.025	2.2385	
120 minute summer	22	Orifice	23	0.3				

Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 99.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	11	20.069	0.199	131.0	1.2898	0.0000	OK
30 minute summer	J1	20	19.903	0.343	117.0	29.6847	0.0000	OK
1440 minute summer	3	1410	19.788	1.088	7.0	1.2303	0.0000	SURCHARGED
1440 minute summer	4	1380	19.787	1.287	6.8	1.4558	0.0000	SURCHARGED
1440 minute summer	SU4_Dock	1380	19.789	0.589	1.6	1.1524	0.0000	FLOOD RISK
1440 minute summer	SU5_Yard	1380	19.789	0.589	6.3	2.8865	0.0000	SURCHARGED
1440 minute summer	6	1380	19.789	0.839	7.9	1.2003	0.0000	SURCHARGED
1440 minute summer	7	1380	19.789	1.409	14.6	2.4901	0.0000	SURCHARGED
15 minute summer	8	10	20.203	0.203	159.0	1.5700	0.0000	OK
1440 minute summer	09	1380	19.788	1.438	24.8	423.2432	0.0000	SURCHARGED
960 minute summer	SU_Entr	930	19.077	0.077	0.6	0.0538	0.0000	OK
1440 minute summer	SU11	1050	19.378	0.838	0.3	0.5469	0.0000	SURCHARGED
960 minute summer	13	930	19.078	0.818	1.5	11.8469	0.0000	SURCHARGED
960 minute summer	15	930	19.077	0.877	1.4	1.4407	0.0000	SURCHARGED
480 minute summer	23	304	18.170	0.030	1.5	0.0341	0.0000	OK
15 minute summer	18	11	19.579	0.021	3.6	0.1660	0.0000	OK
60 minute summer	21	39	19.014	0.058	14.2	1.3249	0.0000	OK
60 minute summer	17	37	19.124	0.624	14.7	0.9363	0.0000	SURCHARGED
60 minute summer	22	37	19.136	0.886	8.6	1.0024	0.0000	SURCHARGED
480 minute summer	EX_TW	304	18.057	0.029	1.5	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	J1	129.1	2.399	0.467	1.2744	
30 minute summer	J1	1.001	3	86.2	2.628	0.853	0.5441	
30 minute summer	J1	Infiltration		1.5				
30 minute summer	3	1.002	4	86.4	2.173	2.040	0.7452	
30 minute summer	4	1.003	7	86.8	1.233	1.223	0.7175	
15 minute summer	SU4_Dock	2.000	6	23.9	0.958	0.673	0.5321	
15 minute summer	SU5_Yard	3.000	6	96.9	1.927	0.401	0.6902	
15 minute summer	6	2.001	7	120.3	2.523	0.357	0.5003	
15 minute summer	7	1.004	09	189.9	1.261	1.463	4.0549	
15 minute summer	8	4.000	09	157.2	2.734	0.500	1.7089	
720 minute summer	09	Head/Flow	13	1.0				
15 minute summer	SU_Entr	Orifice	13	6.2				
15 minute summer	SU11	Orifice	09	4.4				
15 minute summer	13	1.006	15	-14.0	-0.390	-0.062	1.9472	
960 minute summer	15	Orifice	23	1.2				
480 minute summer	23	1.008	EX_TW	1.5	0.604	0.085	0.0280	42.6
15 minute summer	18	7.000	17	0.7	0.614	0.090	0.0103	
15 minute summer	18	Infiltration		2.6				
60 minute summer	21	8.000	17	-7.0	-1.029	-0.880	0.0383	
60 minute summer	21	Infiltration		10.9				
15 minute summer	17	7.001	22	20.3	0.524	0.083	6.9054	
60 minute summer	22	Orifice	23	0.4				

Results for 100 year +25% CC Critical Storm Duration. Lowest mass balance: 99.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	1	20	20.155	0.285	141.9	1.8447	0.0000	OK
30 minute summer	J1	20	20.136	0.576	143.2	34.6232	0.0000	SURCHARGED
960 minute summer	3	615	19.959	1.259	12.5	1.4245	0.0000	SURCHARGED
960 minute summer	4	615	19.960	1.460	12.4	1.6517	0.0000	SURCHARGED
960 minute summer	SU4_Dock	615	19.950	0.750	11.1	1.4678	77.0146	FLOOD
960 minute summer	SU5_Yard	615	19.960	0.760	10.4	3.7235	0.0000	FLOOD RISK
960 minute summer	6	615	19.961	1.011	16.2	1.4461	0.0000	SURCHARGED
960 minute summer	7	615	19.960	1.580	25.3	2.7918	0.0000	SURCHARGED
15 minute summer	8	10	20.230	0.230	191.1	1.7760	0.0000	OK
960 minute summer	09	615	19.961	1.610	43.2	423.8400	0.0000	SURCHARGED
600 minute summer	SU_Entr	465	19.462	0.462	0.9	0.3246	0.0000	FLOOD RISK
720 minute summer	SU11	510	19.765	1.225	0.6	0.7999	1.3499	FLOOD
600 minute summer	13	465	19.464	1.204	2.6	13.1855	0.0000	SURCHARGED
600 minute summer	15	450	19.464	1.264	2.4	2.0749	0.0000	FLOOD RISK
600 minute summer	23	465	18.173	0.033	1.8	0.0377	0.0000	OK
15 minute summer	18	11	19.582	0.024	4.3	0.2179	0.0000	OK
60 minute summer	21	40	19.069	0.113	21.9	3.7525	0.0000	SURCHARGED
60 minute summer	17	37	19.261	0.761	18.2	1.1427	0.0000	SURCHARGED
30 minute summer	22	21	19.287	1.037	15.0	1.1734	0.0000	SURCHARGED
600 minute summer	EX_TW	465	18.060	0.032	1.8	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	J1	154.9	2.472	0.560	1.4501	
30 minute summer	J1	1.001	3	90.9	2.618	0.900	0.5687	
15 minute summer	J1	Infiltration		1.6				
30 minute summer	3	1.002	4	91.1	2.290	2.150	0.7452	
30 minute summer	4	1.003	7	91.4	1.298	1.286	0.7175	
15 minute summer	SU4_Dock	2.000	6	28.7	1.009	0.810	0.6073	
15 minute summer	SU5_Yard	3.000	6	116.4	2.009	0.482	0.7955	
15 minute summer	6	2.001	7	144.6	2.625	0.430	0.5780	
15 minute summer	7	1.004	09	224.5	1.333	1.729	4.5057	
15 minute summer	8	4.000	09	188.9	2.843	0.601	1.9749	
240 minute summer	09	Head/Flow	13	1.0				
15 minute summer	SU_Entr	Orifice	13	7.4				
15 minute summer	SU11	Orifice	09	5.3				
15 minute summer	13	1.006	15	-16.3	-0.398	-0.072	2.3875	
600 minute summer	15	Orifice	23	1.4				
600 minute summer	23	1.008	EX_TW	1.8	0.638	0.103	0.0321	60.6
15 minute summer	18	7.000	17	0.9	0.663	0.118	0.0126	
15 minute summer	18	Infiltration		3.0				
60 minute summer	21	8.000	17	-10.7	-1.424	-1.343	0.0478	
60 minute summer	21	Infiltration		11.2				
15 minute summer	17	7.001	22	22.6	0.539	0.093	6.9054	
30 minute summer	22	Orifice	23	0.5				

Design Settings

Rainfall Methodology	FSR
Return Period (years)	2
Additional Flow (%)	0
FSR Region	England and Wales
M5-60 (mm)	20.000
Ratio-R	0.400
CV	0.750
Time of Entry (mins)	5.00

Maximum Time of Concentration (mins)	30.00
Maximum Rainfall (mm/hr)	50.0
Minimum Velocity (m/s)	1.00
Connection Type	Level Soffits
Minimum Backdrop Height (m)	0.200
Preferred Cover Depth (m)	1.000
Include Intermediate Ground	✓
Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Width (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.295	5.00	21.122	1500		503259.134	175710.558	1.252
J1			20.610			503273.387	175702.666	1.050
3			20.364	1200		503285.857	175695.666	1.664
4			20.298	1200		503276.614	175679.366	1.798
SU4_Dock	0.055	5.00	19.950	700	700	503252.129	175693.560	0.750
SU5_Yard	0.220	5.00	20.198	700	700	503284.033	175680.129	0.998
6			20.416	1350		503270.626	175683.070	1.466
7			20.359	1500		503268.887	175672.725	1.979
8	0.358	5.00	21.138	1350		503237.393	175671.124	1.138
09			20.363	2100		503256.714	175648.543	2.013
SU11	0.014	5.00	19.517	400	400	503242.550	175636.080	0.517
SU10	0.010	5.00	19.765	700	700	503265.646	175631.953	1.225
13			19.766	2100		503235.855	175645.843	1.506
15	0.036	5.00	19.608	1200		503216.809	175655.058	1.408
23			19.617	1200		503210.032	175659.036	1.477
18	0.008	5.00	20.658	450		503153.203	175683.937	1.100
21	0.037	5.00	20.056	450		503158.144	175680.564	1.100
17	0.040	5.00	20.661	1200		503162.121	175685.196	2.161
22			19.631	1200		503200.043	175663.716	1.381
EX_TW			19.485	1200		503202.245	175650.866	1.457

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	J1	16.292	0.600	19.870	19.560	0.310	52.6	375	5.11	50.0
1.001	J1	3	14.300	0.600	19.710	19.175	0.535	26.7	225	5.20	50.0
1.002	3	4	18.738	0.600	18.700	18.575	0.125	149.9	225	5.50	50.0
1.003	4	7	10.189	0.600	18.500	18.458	0.042	242.6	300	5.66	50.0
2.000	SU4_Dock	6	21.265	0.600	19.200	19.100	0.100	212.6	225	5.40	50.0
3.000	SU5_Yard	6	13.726	0.600	19.200	19.000	0.200	68.6	375	5.10	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	2.504	276.5	40.0	0.877	0.675	0.295	0.0	96	1.801
1.001	2.540	101.0	40.0	0.675	0.964	0.295	0.0	98	2.393
1.002	1.065	42.4	40.0	1.439	1.498	0.295	0.0	174	1.207
1.003	1.005	71.0	40.0	1.498	1.601	0.295	0.0	161	1.034
2.000	0.893	35.5	7.5	0.525	1.091	0.055	0.0	70	0.710
3.000	2.189	241.8	29.8	0.623	1.041	0.220	0.0	88	1.506

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
2.001	6	7	10.490	0.600	18.950	18.655	0.295	35.6	375	5.45	50.0
1.004	7	09	27.073	0.600	18.380	18.360	0.020	1353.7	525	6.42	50.0
4.000	8	09	29.719	0.600	20.000	19.270	0.730	40.7	375	5.17	50.0
6.000	SU11	13	11.838	0.600	19.000	18.850	0.150	78.9	225	5.13	50.0
5.000	SU10	09	18.842	0.600	18.540	18.429	0.111	169.7	225	5.31	50.0
1.005	09	13	21.033	0.600	18.350	18.260	0.090	233.7	500	6.66	50.0
1.006	13	15	21.158	0.600	18.260	18.200	0.060	352.6	500	6.97	50.0
1.007	15	23	7.858	0.600	18.260	18.140	0.120	65.5	225	7.05	50.0
7.000	18	17	9.006	0.600	19.558	19.406	0.152	59.3	100	5.15	50.0
8.000	21	17	6.105	0.600	18.956	18.850	0.106	57.6	100	5.10	50.0
7.001	17	22	43.583	0.600	18.500	18.250	0.250	174.3	450	5.62	50.0
7.002	22	23	11.031	0.600	18.250	18.140	0.110	100.3	150	5.81	50.0
1.008	23	EX_TW	11.287	0.600	18.140	18.028	0.112	100.8	150	7.24	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
2.001	3.047	336.5	37.3	1.091	1.329	0.275	0.0	84	2.038
1.004	0.600	129.9	77.2	1.454	1.478	0.570	0.0	292	0.625
4.000	2.847	314.4	48.5	0.763	0.718	0.358	0.0	99	2.082
6.000	1.473	58.6	1.9	0.292	0.691	0.014	0.0	28	0.679
5.000	1.000	39.8	1.4	1.000	1.709	0.010	0.0	29	0.469
1.005	1.416	278.1	127.1	1.513	1.006	0.938	0.0	237	1.385
1.006	1.151	226.0	129.0	1.006	0.908	0.952	0.0	271	1.187
1.007	1.618	64.3	133.9	1.123	1.252	0.988	0.0	225	1.648
7.000	1.002	7.9	1.1	1.000	1.155	0.008	0.0	25	0.706
8.000	1.017	8.0	5.0	1.000	1.711	0.037	0.0	57	1.073
7.001	1.536	244.4	11.5	1.711	0.931	0.085	0.0	65	0.799
7.002	1.003	17.7	11.5	1.231	1.327	0.085	0.0	88	1.067
1.008	1.001	17.7	145.4	1.327	1.307	1.073	0.0	150	1.019

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	16.292	52.6	375	Circular	21.122	19.870	0.877	20.610	19.560	0.675
1.001	14.300	26.7	225	Circular	20.610	19.710	0.675	20.364	19.175	0.964
1.002	18.738	149.9	225	Circular	20.364	18.700	1.439	20.298	18.575	1.498
1.003	10.189	242.6	300	Circular	20.298	18.500	1.498	20.359	18.458	1.601
2.000	21.265	212.6	225	Circular	19.950	19.200	0.525	20.416	19.100	1.091
3.000	13.726	68.6	375	Circular	20.198	19.200	0.623	20.416	19.000	1.041
2.001	10.490	35.6	375	Circular	20.416	18.950	1.091	20.359	18.655	1.329

Link	US Node	Dia (mm)	Width (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1500		Manhole	Adoptable	J1		Junction	
1.001	J1			Junction		3	1200	Manhole	Adoptable
1.002	3	1200		Manhole	Adoptable	4	1200	Manhole	Adoptable
1.003	4	1200		Manhole	Adoptable	7	1500	Manhole	Adoptable
2.000	SU4_Dock	700	700	Manhole	Adoptable	6	1350	Manhole	Adoptable
3.000	SU5_Yard	700	700	Manhole	Adoptable	6	1350	Manhole	Adoptable
2.001	6	1350		Manhole	Adoptable	7	1500	Manhole	Adoptable

Pipeline Schedule

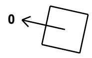
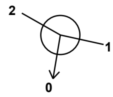
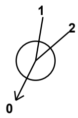
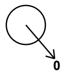
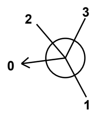
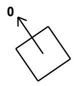
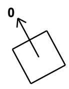
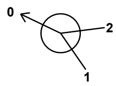
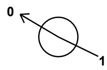
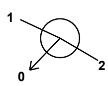
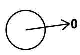
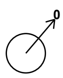
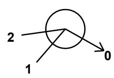
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.004	27.073	1353.7	525	Circular	20.359	18.380	1.454	20.363	18.360	1.478
4.000	29.719	40.7	375	Circular	21.138	20.000	0.763	20.363	19.270	0.718
6.000	11.838	78.9	225	Circular	19.517	19.000	0.292	19.766	18.850	0.691
5.000	18.842	169.7	225	Circular	19.765	18.540	1.000	20.363	18.429	1.709
1.005	21.033	233.7	500	Circular	20.363	18.350	1.513	19.766	18.260	1.006
1.006	21.158	352.6	500	Circular	19.766	18.260	1.006	19.608	18.200	0.908
1.007	7.858	65.5	225	Circular	19.608	18.260	1.123	19.617	18.140	1.252
7.000	9.006	59.3	100	Circular	20.658	19.558	1.000	20.661	19.406	1.155
8.000	6.105	57.6	100	Circular	20.056	18.956	1.000	20.661	18.850	1.711
7.001	43.583	174.3	450	Circular	20.661	18.500	1.711	19.631	18.250	0.931
7.002	11.031	100.3	150	Circular	19.631	18.250	1.231	19.617	18.140	1.327
1.008	11.287	100.8	150	Circular	19.617	18.140	1.327	19.485	18.028	1.307

Link	US Node	Dia (mm)	Width (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.004	7	1500		Manhole	Adoptable	09	2100	Manhole	Adoptable
4.000	8	1350		Manhole	Adoptable	09	2100	Manhole	Adoptable
6.000	SU11	400	400	Manhole	Adoptable	13	2100	Manhole	Adoptable
5.000	SU10	700	700	Manhole	Adoptable	09	2100	Manhole	Adoptable
1.005	09	2100		Manhole	Adoptable	13	2100	Manhole	Adoptable
1.006	13	2100		Manhole	Adoptable	15	1200	Manhole	Adoptable
1.007	15	1200		Manhole	Adoptable	23	1200	Manhole	Adoptable
7.000	18	450		Manhole	Adoptable	17	1200	Manhole	Adoptable
8.000	21	450		Manhole	Adoptable	17	1200	Manhole	Adoptable
7.001	17	1200		Manhole	Adoptable	22	1200	Manhole	Adoptable
7.002	22	1200		Manhole	Adoptable	23	1200	Manhole	Adoptable
1.008	23	1200		Manhole	Adoptable	EX_TW	1200	Manhole	Adoptable

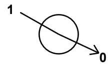
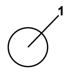
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections	Link	IL (m)	Dia (mm)
1	503259.134	175710.558	21.122	1.252	1500		0	1.000	19.870	375
J1	503273.387	175702.666	20.610	1.050			1	1.000	19.560	375
							0	1.001	19.710	225
3	503285.857	175695.666	20.364	1.664	1200		1	1.001	19.175	225
							0	1.002	18.700	225
4	503276.614	175679.366	20.298	1.798	1200		1	1.002	18.575	225
							0	1.003	18.500	300
SU4_Dock	503252.129	175693.560	19.950	0.750	700	700	0	2.000	19.200	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections		Link	IL (m)	Dia (mm)
SU5_Yard	503284.033	175680.129	20.198	0.998	700	700		0	3.000	19.200	375
6	503270.626	175683.070	20.416	1.466	1350			1	3.000	19.000	375
								2	2.000	19.100	225
								0	2.001	18.950	375
7	503268.887	175672.725	20.359	1.979	1500			1	2.001	18.655	375
								2	1.003	18.458	300
								0	1.004	18.380	525
8	503237.393	175671.124	21.138	1.138	1350			0	4.000	20.000	375
09	503256.714	175648.543	20.363	2.013	2100			1	5.000	18.429	225
								2	4.000	19.270	375
								3	1.004	18.360	525
								0	1.005	18.350	500
SU11	503242.550	175636.080	19.517	0.517	400	400		0	6.000	19.000	225
SU10	503265.646	175631.953	19.765	1.225	700	700		0	5.000	18.540	225
13	503235.855	175645.843	19.766	1.506	2100			1	6.000	18.850	225
								2	1.005	18.260	500
								0	1.006	18.260	500
15	503216.809	175655.058	19.608	1.408	1200			1	1.006	18.200	500
								0	1.007	18.260	225
23	503210.032	175659.036	19.617	1.477	1200			1	7.002	18.140	150
								2	1.007	18.140	225
								0	1.008	18.140	150
18	503153.203	175683.937	20.658	1.100	450			0	7.000	19.558	100
21	503158.144	175680.564	20.056	1.100	450			0	8.000	18.956	100
17	503162.121	175685.196	20.661	2.161	1200			1	8.000	18.850	100
								2	7.000	19.406	100
								0	7.001	18.500	450

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections		Link	IL (m)	Dia (mm)
22	503200.043	175663.716	19.631	1.381	1200			1	7.001	18.250	450
								0	7.002	18.250	150
EX_TW	503202.245	175650.866	19.485	1.457	1200			1	1.008	18.028	150

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	20.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.400	Check Discharge Rate(s)	x
Summer CV	0.750	Check Discharge Volume	✓
Analysis Speed	Normal	100 year +40% 360 minute (m³)	2261

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	40	0	0

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	40
Positively Drained Area (ha)	9.000	Storm Duration (mins)	360
Soil Index	5	Betterment (%)	0
SPR	0.53	PR	0.287
CWI	1.000	Runoff Volume (m³)	2261

Node 09 Online Head/Flow Control

Flap Valve	x	Invert Level (m)	18.350	Design Flow (l/s)	1.0
Replaces Downstream Link	✓	Design Depth (m)	0.500		

Head (m)	Flow (l/s)
0.500	1.000

Node SU10 Online Orifice Control

Flap Valve	✓	Design Depth (m)	1.000	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	100.0		
Invert Level (m)	18.540	Diameter (m)	0.225		

Node 15 Online Orifice Control

Flap Valve	x	Design Depth (m)	1.000	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	1.3		
Invert Level (m)	18.260	Diameter (m)	0.025		

Node 22 Online Orifice Control

Flap Valve	x	Design Depth (m)	1.000	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	0.5		
Invert Level (m)	18.250	Diameter (m)	0.015		

Node SU11 Online Orifice Control

Flap Valve	✓	Design Depth (m)	0.225	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	35.0		
Invert Level (m)	19.000	Diameter (m)	0.223		

Node J1 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	19.560	Depth (m)	0.400
Side Inf Coefficient (m/hr)	0.26460	Time to half empty (mins)	18	Inf Depth (m)	
Safety Factor	5.0	Pit Width (m)	7.000	Number Required	1
Porosity	0.95	Pit Length (m)	13.000		

Node 09 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	18.350
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	550.0	0.0	0.800	550.0	0.0	0.801	0.0	0.0

Node 13 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	18.260
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	100.0	0.0	0.300	100.0	0.0	0.301	0.0	0.0

Node 18 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	19.558	Slope (1:X)	500.0
Side Inf Coefficient (m/hr)	1.33200	Time to half empty (mins)	0	Depth (m)	0.400
Safety Factor	5.0	Width (m)	5.000	Inf Depth (m)	
Porosity	0.30	Length (m)	16.800		

Node 21 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	18.956	Slope (1:X)	500.0
Side Inf Coefficient (m/hr)	1.33200	Time to half empty (mins)	148	Depth (m)	0.400
Safety Factor	5.0	Width (m)	5.000	Inf Depth (m)	
Porosity	0.30	Length (m)	29.000		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +40% CC 15 minute summer	488.233	138.153	100 year +40% CC 360 minute summer	56.677	14.585
100 year +40% CC 30 minute summer	320.551	90.705	100 year +40% CC 480 minute summer	43.979	11.622
100 year +40% CC 60 minute summer	214.603	56.713	100 year +40% CC 600 minute summer	35.604	9.738
100 year +40% CC 120 minute summer	129.587	34.246	100 year +40% CC 720 minute summer	31.433	8.424
100 year +40% CC 180 minute summer	97.729	25.149	100 year +40% CC 960 minute summer	25.432	6.697
100 year +40% CC 240 minute summer	75.977	20.078	100 year +40% CC 1440 minute summer	18.055	4.839

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.34%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	1	20	20.692	0.822	158.8	5.3260	0.0000	SURCHARGED
30 minute summer	J1	20	20.610	1.050	158.8	34.6232	0.9881	FLOOD
600 minute summer	3	360	20.058	1.358	21.8	1.5354	0.0000	SURCHARGED
600 minute summer	4	360	20.048	1.548	21.6	1.7503	0.0000	FLOOD RISK
1440 minute summer	SU4_Dock	810	19.950	0.750	23.3	1.4678	245.4372	FLOOD
600 minute summer	SU5_Yard	360	20.043	0.843	16.3	4.1316	0.0000	FLOOD RISK
600 minute summer	6	360	20.043	1.093	30.1	1.5642	0.0000	SURCHARGED
600 minute summer	7	360	20.046	1.666	41.9	2.9432	0.0000	SURCHARGED
15 minute summer	8	10	20.249	0.249	213.9	1.9261	0.0000	OK
600 minute summer	09	360	20.046	1.696	69.2	424.1377	0.0000	SURCHARGED
960 minute summer	SU11	540	19.517	0.517	0.7	0.3629	2.2505	FLOOD
1440 minute summer	SU10	810	19.765	1.225	0.4	0.7999	2.7004	FLOOD
600 minute summer	13	360	19.608	1.348	2.4	13.6857	0.0000	FLOOD RISK
600 minute summer	15	360	19.608	1.408	2.8	2.3119	0.8285	FLOOD
360 minute summer	23	232	18.176	0.035	2.1	0.0401	0.0000	OK
180 minute summer	18	112	19.633	0.075	3.5	1.4809	0.0000	OK
120 minute summer	21	72	19.662	0.706	19.6	16.7502	0.0000	SURCHARGED
60 minute summer	17	42	19.633	1.133	18.5	1.7003	0.0000	SURCHARGED
180 minute summer	22	104	19.631	1.381	6.1	1.5619	5.3124	FLOOD
360 minute summer	EX_TW	232	18.063	0.035	2.1	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	J1	173.2	2.505	0.626	1.7970	
30 minute summer	J1	1.001	3	103.6	2.659	1.026	0.5687	
15 minute summer	J1	Infiltration		0.2				
30 minute summer	3	1.002	4	103.7	2.607	2.448	0.7452	
30 minute summer	4	1.003	7	104.2	1.479	1.466	0.7175	
15 minute summer	SU4_Dock	2.000	6	32.1	1.040	0.906	0.6580	
15 minute summer	SU5_Yard	3.000	6	130.4	2.059	0.539	0.8689	
15 minute summer	6	2.001	7	161.9	2.686	0.481	0.6453	
15 minute summer	7	1.004	09	243.8	1.380	1.877	4.7399	
15 minute summer	8	4.000	09	211.5	2.906	0.673	2.1625	
120 minute summer	09	Head/Flow	13	1.0				
15 minute summer	SU11	Orifice	13	8.4				
15 minute summer	SU10	Orifice	09	6.0				
15 minute summer	13	1.006	15	-18.1	-0.410	-0.080	2.7011	
240 minute summer	15	Orifice	23	1.5				
360 minute summer	23	1.008	EX_TW	2.1	0.661	0.116	0.0352	50.7
30 minute summer	18	7.000	17	4.2	0.887	0.530	0.0579	
180 minute summer	18	Infiltration		0.2				
30 minute summer	21	8.000	17	-14.5	-1.854	-1.816	0.0478	
60 minute summer	21	Infiltration		1.9				
15 minute summer	17	7.001	22	21.8	0.575	0.089	6.9054	
60 minute summer	22	Orifice	23	0.6				

APPENDIX E – MANAGEMENT & MAINTENANCE PLAN

Burrows Graham

TECHNICAL NOTE

DRAINAGE MAINTENANCE PLAN

LAND AT JUPITER HOUSE, HORTON ROAD, COLNBROOK, SLOUGH, SL3 0BB

DOCUMENT CONTROL SHEET

Issued by: Burrows Graham Limited
Buckland House,
Dower Mews,
Berkhamsted, Herts
HP4 2BL

Tel: 01442 508402

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Title: Technical Note – Drainage Management & Maintenance Plan

Status: Preliminary

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Prepared By: PG

Checked By: DB

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1	06/04/2023	First Issue

1 INTRODUCTION

This document has been prepared to provide a maintenance methodology to the surface water drainage elements proposed for this development. If any discrepancies from manufactures guidance are encountered, the proprietary system guidance should be adopted, refer to enclosed Appendices.

This drainage system's management and maintenance will be the responsibility of Panattoni / PDC UK 7 Ltd, who will appoint a suitable management company, or pass this document to future occupiers & tenants, with this document used as a reference point for how the drainage maintenance will be implemented. This document will be included in the final O&M File to be compiled on completion of the development and will include details of the As Built drainage, and detailed maintenance document for installed proprietary drainage systems.

The surface water drainage works are composed of the following:

- Linear drainage channels, connecting pipe network, manholes & inspection chambers
- Permeable paving
- Geocellular Infiltration / attenuation tanks.
- Oil separators

Refer to drawing 22232-BGL-XX-X-DR-C-0210 for the Proposed Drainage Layout.

Any man-entry into the system and silt removal should be carried out by trained personnel with adequate personal protective equipment. Approved safety procedures must be followed in accordance with the Health and Safety Act.

Long-term management practices include monthly sweeping of external paved areas. The sweeping program will remove sand and contaminants directly from paved surfaces before they become mobilised during storm events and transported to the drainage system.

During the winter months, drainage features such as gullies and channels should be cleared of ice, snow, debris or litter

Sediment/material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols; especially where run-off is taken from potentially contaminated areas such as the filter drains and the upstream/downstream chambers

2 MAINTENANCE STRATEGY

2.1 INSPECTION, MANHOLE AND CATCHPIT CHAMBERS

Access points have been located at the head of each run, at a change in direction and at a change of pipe size in accordance with Building Regulations Part H.

The appropriate health and safety equipment must be used when accessing manholes. Confined space certificates must be held by any personnel entering a manhole and the appropriate permits should be obtained from the Maintenance Manager prior to any access.

2.2 PIPES

Pipes are proprietary products and the materials can vary across the site and as such where used the manufacture's recommendations should be followed. Regardless of the product used, the pipes will be fully compliant with the Curtins drainage specification.

Pipes are intended to be the main conveyance across the development and where oversized they form the attenuation volume required by the limitation of the discharge rate. They are intended to be dry except for during rainfall events. These have been designed to be self-cleaning where possible for smaller diameter pipes, and for larger diameters the risk is reduced due to the overall pipe size.

Access for maintenance is provided through access chambers and manholes.

Regular inspection and maintenance are important to identify areas which may have been obstructed / clogged and may not be drainage correctly thus exposing the development to a greater level of flood risk.

2.3 CHANNELS & GULLIES

Channels and gullies should be inspected and cleaned in accordance with the manufacturer's details. Channel units can be cleaned through the use of a high-pressure hose; this can be fed into the channel system through access units strategically placed along the channel run. The throat section of channel units should be kept clear at all times to ensure uninterrupted flow of surface water into the drainage channel and any debris within the throat should be removed.

Locking bolts should be replaced and sufficiently tightened, taking care that the bolt heads do not stand above the top surface of the cover or grate. If covers are allowed to move within their frame, this may cause damage to the frame or seating

Maintenance schedule	Required action	Typical frequency
Regular Maintenance	Remove manhole and chamber covers to sewers and flow control on network– inspect to ensure water is flowing freely and that the water flow route is unobstructed. Remove debris and silt as required.	Half Yearly Undertake one of these inspections after leaf fall in autumn
Occasional Maintenance	None required	
Remedial Actions	Re-line or replace pipework if unable to clear blockages by jetting.	As required
Monitoring	Inspect chambers for build-up of silt and debris	Half yearly

Table 1 – Operation & maintenance requirements for pipe network, manholes & inspection chambers, drainage channels & gullies.

2.4 ATTENUATION / INFILTRATION TANKS

Geocellular tanks are modular storage systems made with plastic units. These units can be assembled to achieved re required volume and usually on multiple layers. Generally, the units have 95% of voids content and are used to create an efficient below ground structure to store surface water.

The geocellular units and geotextile are proprietary products and therefore manufacturer's recommendations should also be taken into consideration.

Access for maintenance should be provided by an access shaft located on the tank and from the manhole chambers downstream of the tank.

Regular inspection and maintenance are important for the effective operation of attenuation tanks as designed. As the feature is buried, a regular inspection regime is very important to ensure the correction functionality of the surface water drainage network.

Maintenance schedule	Required action	Typical frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually.
	Remove debris form the catchment surface (where it may cause risks to performance).	Monthly.
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockages by sediment, algae or other matter; remove and replace surface infiltration medium as required.	Annually.
	Remove sediments from pre-treatment structures and/or internal forebays.	Annually, or as required.
Remedial Actions	Repair/rehabilitate inlets, outlets, overflows and vents.	As required.
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.	Annually
	Survey inside of tank for sediment build-up and remove if necessary.	Every 5 years or as required.

Table 2 – Operation & maintenance requirements for attenuation storage tanks - Based on CIRIA SuDS Manual 2015

2.5 POROUS PAVED AREA

Permeable surfacing enables any water landing on the surface to infiltrate directly to ground at source, thus acting close to a permeable surface.

Regular inspection and maintenance are important for the effective operation of the permeable surfacing to allow it to work efficiently through it s design life.

Maintenance schedule	Required action	Typical frequency
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surfaces from adjacent impermeable areas as this is most likely to collect the most sediment.
Occasional Maintenance	Stabilise and mow contributing and adjacent areas.	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements.
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the surface.	As required
	Remedial works to any depressions, rutting and cracked considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping.	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Inspect for evidence of poor operation and/or weed growth -if required, take remedial action	Three-monthly, 48 hours after large storms in the first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually
	Monitor inspection chambers	Annually

Table 3 – Operation & Maintenance requirements for Porous Paved Area – CIRIA SuDS Manual 2015

2.6 PROPRIETARY SURFACE WATER TREATMENT SYSTEMS

These are manufactured products to provide a treatment to the surface water by removing specific pollutant, such as petrol interceptors.

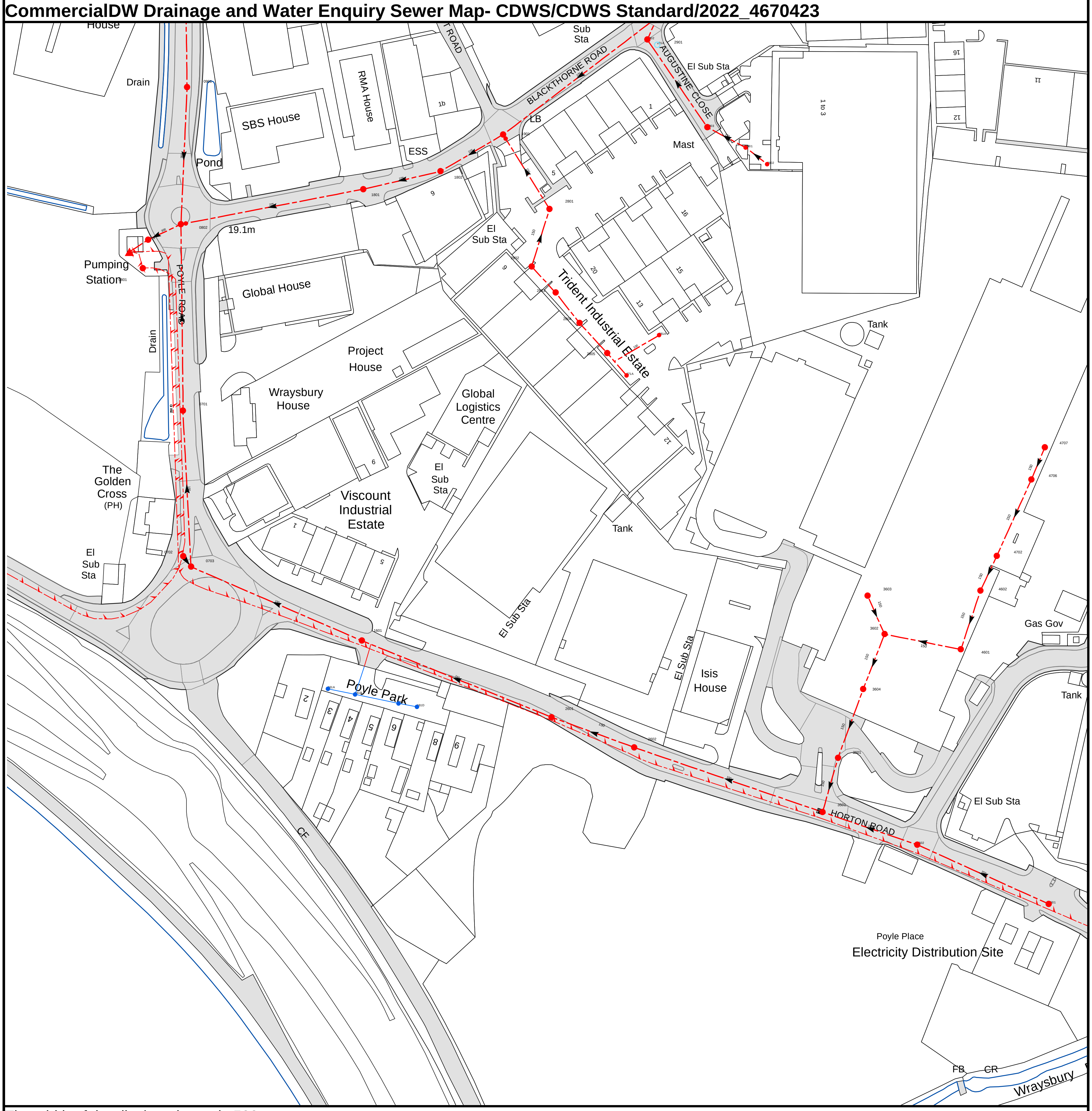
Table 4 sets out the recommended maintenance actions and frequency. Manufacture guidance/recommendations should always be used when available.

Maintenance schedule	Required action	Typical frequency
Regular Maintenance	Remove litter and debris and inspect for sediment, oil and grease accumulation.	Monthly for 3 months, then annually.
	Change the filter media.	As recommended by manufacturer.
	Remove sediment, oil grease and floatables.	As necessary – indicated by system inspections or immediately following significant spill.
Remedial Actions	Replace malfunctioning parts or structures.	As required.
Monitoring	Inspect for evidence of poor operation.	Biannually
	Inspect filter media and establish appropriate replacement frequencies.	Biannually
	Inspect sediment accumulation rates and establish removal frequencies.	Monthly during first half year of operation, then every six months.

Table 4 – Operation & maintenance requirements for proprietary surface water treatment systems - CIRIA SuDS Manual 2015

APPENDIX F – THAMES WATER SEWER MAPS

CommercialDW Drainage and Water Enquiry Sewer Map- CDWS/CDWS Standard/2022_4670423



The width of the displayed area is 500m

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no survey information is available.

Manhole Reference	Manhole Cover Level	Manhole Invert Level
271A	n/a	n/a
2805	20.13	18.29
281A	n/a	n/a
2804	20.12	17.91
2602	19.36	16.37
2601	19.46	16.03
161D	n/a	n/a
161C	n/a	n/a
161B	n/a	n/a
161A	n/a	n/a
1601	19.4	15.52

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

APPENDIX G – THAMES WATER CONSULTATION CORRESPONDANCE

Wastewater pre-planning
Our ref DS6103632

Mr Darren Barnes

Burrows Graham
Buckland House
Dower Mews
Berkhampstead
Hertfordshire
HP4 2BL

27 April 2023

Pre-planning enquiry: Confirmation of sufficient capacity

Site: LAND AT JUPITER HOUSE, HORTON ROAD, COLNBROOK, SLOUGH, SL3 0BB.

Dear Mr Barnes,

Thank you for providing information on your development

Proposed development: Warehouse - 7330 Proposed FW point(s) of connection: One property to TW Manhole 2601. One property with branch connection to TW sewer between Manhole 2601 and 1601.(Gravity) Proposed SW point(s) of connection: a combination of: Infiltration to ground. AND Attenuation and discharge @ 2.0l/s into existing FW system. As per current strategy. (Gravity).

We have completed the assessment of the foul water flows and surface water run-off based on the information submitted in your application with the purpose of assessing sewerage capacity within the existing Thames Water sewer network.

Foul Water

If your proposals progress in line with the details you've provided, we're pleased to confirm that there will be sufficient sewerage capacity in the adjacent foul water sewer network to serve your development.

This confirmation is valid for 12 months or for the life of any planning approval that this information is used to support, to a maximum of three years.

You'll need to keep us informed of any changes to your design – for example, an increase in the number or density of homes. Such changes could mean there is no longer sufficient capacity.

Surface Water

In accordance with the Building Act 2000 Clause H3.3, positive connection of surface water to a public sewer will only be consented when it can be demonstrated that the hierarchy of disposal methods have been examined and proven to be impracticable. Before we can consider your surface water needs, you'll need written approval from the lead local flood authority that you have followed the sequential approach to the disposal of surface water and considered all practical means.

The disposal hierarchy being:

1) rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)
2) rainwater infiltration to ground at or close to source
3) rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)
4) rainwater discharge direct to a watercourse (unless not appropriate)
5) controlled rainwater discharge to a surface water sewer or drain
6) controlled rainwater discharge to a combined sewer.

Where connection to the public sewerage network is required to manage surface water flows we will accept these flows at a discharge rate in line with CIRIA's best practice guide on SuDS or that stated within the sites planning approval.

If the above surface water hierarchy has been followed and if the flows are restricted to a total of 2.0 l/s then Thames Water would not have any objections to the proposal.

Please see the attached 'Planning your wastewater' leaflet for additional information.

What happens next?
Please make sure you submit your connection application, giving us at least 21 days' notice of the date you wish to make your new connection/s.

If you've any further questions, please contact me on 0800 009 3921.

Yours Sincerely

Christopher Allen
Project Engineer
Developer Services – Sewer Connections Team
Tel: 0800 009 3921
@: Developer.services@thameswater.co.uk

Get advice on making your connection correctly at connectright.org.uk

Clearwater Court, Vastern Road, Reading, RG1 8DB
Find us online at developers.thameswater.co.uk

APPENDIX H – SLOUGH BOROUGH COUNCIL SUDS ASSESSMENT

Slough Borough Council Surface Water Drainage Pro-Forma

This pro-forma accompanies Slough Borough Council's developer guide. It should be completed for all **major** planning applications and submitted to the Local Planning Authority, referencing from where in their submission documents this information is taken. The pro-forma is supported by the Defra/EA guidance on Rainfall Runoff Management. Developers are encouraged to use the tools available at www.UKsuds.com when completing the pro-forma. The tools available at www.UKsuds.com helps developers to comply with the requirements of the National Planning Policy Framework and provides a quick tool for assessing storage requirements. The quick tool should only be used at the outline planning stage to assist with estimating indicative volumes. Detailed design, which must be carried out at the full planning application stage, will always require the use of suitable software to confirm or modify the storage proposals as well as address conveyance and the many other aspects of drainage design.

This pro-forma is based upon current industry standard practice (National Non-statutory Technical Standards, CIRIA SUDS Manual 697 and Site Construction Handbook CIRIA 698).

1. Site Details

Site	Land at Jupiter House
Address & post code or LPA reference	Horton Road, Colnbrook, Slough, SL3 0BB
Grid reference	503224, 175712
Is the existing site developed or Greenfield?	Brownfield
Total Site Area served by drainage system (excluding open space) (Ha)*	1.3 Ha
Topographical survey plan showing existing site layout, site levels and existing drainage system	

***** The Greenfield runoff off rate from the development which is to be used for assessing the requirements for limiting discharge flow rates and attenuation storage from a site should be calculated for the area that forms the drainage network for the site whatever size of site and type of drainage technique. Please refer to the Rainfall Runoff Management document or CIRIA manual for detail on this.

2. Impermeable Area

	Existing	Proposed	Difference (Proposed-Existing)	Location of evidence – document and page no	Notes for developers & Local Authorities
Impermeable area (ha) **(areas to be shown on a plan)**	1.299 Ha	1.173 Ha	0.126 Ha	Existing and Proposed Impermeable Areas Drawing - 22232-BGL-XX-XX-DR-C -00252	If the proposed amount of impermeable surface is greater, then runoff rates and volumes will increase. Section 6 must be filled in. If proposed impermeability is equal or less than existing, then section 6 can be skipped & section 7 filled in.
Drainage Method (infiltration/sewer/watercourse)	Sewer	Hybrid system - Sewer and Infiltration	N/A	Drainage Drawing - 22232-BGL-XX-XX-DR-C-00210	If different from the existing, please fill in section 3. If existing drainage is by infiltration and the proposed is not, discharge volumes may increase. Fill in section 6.

<u>PPG Paragraph 080</u>

3a. Proposing to discharge surface water via

	Yes	No	Evidence / Location of evidence – document and page no	Notes for developers & Local Authorities
Micro Drainage calculations of the existing and proposed drainage systems		No	Flow Calculations PDF for proposed	Please provide Micro Drainage calculations of existing and proposed run-off rates and volumes in accordance with a recognised methodology or the results of a full infiltration test (see line below) if infiltration is proposed.
Infiltration				e.g. soakage tests. Section 7 (infiltration) must be filled in if infiltration is proposed.
To watercourse		No		e.g. Is there a watercourse nearby? Please provide details of any watercourse to which the site drains including cross-sections of any adjacent water courses for appropriate distance upstream and downstream of the discharge point (as agreed with the LLFA and/or EA)
To surface water sewer				Confirmation from sewer provider that sufficient capacity exists for this connection.
Combination of above	Yes		Soakaway and to surface water	e.g. part infiltration part discharge to sewer or watercourse. Provide evidence above.

Drainage drawing and flow calculations PDF for evidence

3b. Additional drainage strategy information

	Yes	No	Evidence / Location of evidence – document and page no	Notes for developers & Local Authorities
Has the drainage proposal had regard to the SuDS hierarchy?	Yes		Drainage drawing. Soakaway and overflow to surface water	Evidence must be provided to demonstrate that the proposed Sustainable Drainage proposal has had regard to the SuDS hierarchy.
Drainage layout plan including; location of data collection points (eg infiltration points); sustainable drainage infrastructure; significant utility plant and trees; and drainage structures (proposed & existing)	Yes		Drainage drawing	Please provide plan reference numbers for the site layout showing where the sustainable drainage infrastructure will be located on the site. If the development is to be constructed in phases this should be shown on a separate plan and confirmation should be provided that the sustainable drainage proposal for each phase can be constructed and can operate independently and is not reliant on any later phase of development.
Exceedance flow paths **(flow paths to be shown on a plan)**	Yes		Exceedance flow arrows on drainage drawing	

<u>Technical Standards S2 and S3</u>

4a. Peak Discharge Rates – Greenfield Sites – This is the maximum flow rate at which surface water runoff leaves the site during a particular storm event.

	Existing Rates (l/s)	Proposed Rates (l/s)	Difference (l/s) (Proposed-Existing)	Location of evidence – document and page no	Notes for developers & Local Authorities
Greenfield QBAR		N/A	N/A		Mean annual Greenfield peak flow - QBAR is approx. 1 in 2 storm events. Use that figure in Section 7a.
1 in 1					Proposed discharge rates (with mitigation) should be no greater than existing rates for all corresponding storm events. e.g. discharging all flow from site at the existing 1 in 100 event increases flood risk during smaller events.
1 in 30					
1in 100					
1 in 100 plus climate change	N/A				To mitigate for climate change the proposed 1 in 100 +CC must be no greater than the existing 1 in 100 runoff rate. If not, flood risk increases under climate change. 20% should be added to the peak rainfall intensity for commercial and 30% should be added for residential properties.

4b. Peak Discharge Rates – Brownfield Sites – This is the maximum flow rate at which surface water runoff leaves the site during a particular storm event. Proposed drainage need to be reduced as per the Local Policy.

	Existing Rates (l/s)	Proposed Rates (l/s)	Difference (l/s) Proposed % reduction	Location of evidence – document and page no	Notes for developers & Local Authorities
Drainage peak discharge rates	Existing Soakaway	Soakaway designed to 5.4 x 10-5m/s and 1.5 L/S overflow	N/A	Drainage network designed based on storm events upto 1 in 100 + 25%, sensitivity check based on 100 + 40% CC to ensure that there is no flooding to building and third party land.	Existing peak discharge rate cannot be greater than the capacity of the receiving system. Actual % reductions will be subject to the characteristics of the catchment.

Technical Standards S4 to S9

5. Calculate Discharge Volumes – The total volume of water leaving the development site for a particular rainfall event. Introducing new impermeable surfaces increases surface water runoff and may increase flood risk outside the development.

	Existing Rates (l/s)	Proposed Rates (l/s)	Difference (l/s) (Proposed-Existing)	Location of evidence – document and page no	Notes for developers & Local Authorities
Greenfield QBAR		N/A	N/A		Proposed discharge volumes (without mitigation) should be no greater than existing volumes for all corresponding storm events. Any increase in volume increases flood risk elsewhere. Where volumes are increased section 6 must be filled in.
1 in 1					
1 in 30					
1in 100					
1 in 100 plus climate change	N/A				To mitigate for climate change the volume discharged from the site must be no greater than the existing 1 in 100 storm event. If not, flood risk increases under climate change.

6. Calculate attenuation storage – In order to minimise the negative impact on flood risk resulting from increased volumes of runoff from the proposed development, storage must be provided.

	Location of evidence – document and page no	Notes for developers & Local Authorities
Storage volume required to retain discharge rates as existing (m^3)	Unknown	Volume of water to attenuate on site if discharging at existing rates. Can't be used where discharge volumes are increasing.
Where will the storage be provided on site?	Refer to drainage plan. Soakaway positioned 5m away from building and boundary as per building regulation guidance	

7a. How is Storm Water stored on site? – Storage is required for the additional volume from site but also for holding back water to slow down the rate from the site. This is known as attenuation storage and long term storage. The intention is to not discharge that volume into the watercourses so as not to increase flood risk elsewhere.

		Location of evidence – document and page no	Notes for developers & Local Authorities
Infiltration	**State the Site's Geology/drift material overlaying)**	Refer to section 6.3 of the FRA	Avoid infiltrating in made ground.
	Does the site have a high ground water table? Yes/No?	Yes	If yes, please provide details of the site's hydrology.
	Is the site within a known Source Protection Zones (SPZ)? Yes/No?	No	Refer to the Environment Agency website to identify source protection zones (SPZ). However the aquifers are multi-layered in Slough and local knowledge may prevail.
	Are infiltration rates suitable?	Yes	Permeability tests (BRE 365) must be taken at the depth and location of significant infiltration features. Infiltration rates should be no lower than $1x10^{-6}$ m/s.
	Is the site contaminated? If yes, consider advice from others on whether infiltration can happen.	No contamination	Water should not be infiltrated through land that is contaminated. The Environment Agency may provide bespoke advice in planning consultations for contaminated sites that should be considered.

	State the distance between a proposed infiltration device base and the ground water (GW) level	100mm	Need 1metre (min) between the base of the infiltration device & the water table to protect Groundwater quality & ensure GW doesn't enter infiltration devices. Avoid infiltration where this isn't possible. If groundwater is found to be 1.5 metres from any significant drainage element, a log of groundwater levels must be provided for a suitable period of time (dependent on prevailing weather conditions/regional water levels).
	Were infiltration rates obtained by desk study or infiltration test?	Infiltration tests	Infiltration rates MUST be obtained by infiltration tests in accordance with BRE365. Note, Thames Water will not allow the use of a back-up attenuation scheme that overflows via pipe into the surface water sewer.
	What factor of safety has been used?	Safety factor of 5	State what factor of safety has been used, and whether it is adequate. Typically a factor >2 should be used increasing up to 10 on a sloping site where there is flood risk from exceedance.
Is infiltration feasible?	**Yes/No?**	Soakaway designed to 5.4 x 10-5m/s	If infiltration is not feasible how will the additional volume be stored?. The applicant should then consider the following options in the next section.

7b. Storage requirements – Where infiltration is not possible, then the developer must confirm that either of the two options below will be implemented for dealing with the amount of water that needs to be stored on site.

Option 1 Simple – Store both the additional volume and attenuation volume in order to make a final discharge to the surface water sewer from site at **QBAR**. This is preferred if no infiltration can be made on site. This very simply satisfies the runoff rates and volume criteria.

Option 2 Complex – If some of the additional volume of water can be infiltrated back into the ground, the remainder can be discharged to the surface water sewer at a very low rate of 2 l/sec/hectare. A combined storage calculation using the partial permissible rate of 2 l/sec/hectare and the attenuation rate used to slow the runoff from site.

	Location of evidence – document and page no	**Notes for developers & Local Authorities**
Please confirm what option has been chosen and how much storage is required on site.	Refer to drainage drawing	The developer at this stage should understand the site characteristics and be able to explain what the storage requirements are on site and how it will be achieved.

8. SuDS for Roads – If SuDS for roads has been proposed, details of these SuDS elements should be specified.

	Location of evidence – document and page no	Notes for developers & Local Authorities
Which SuDS elements are used for road drainage?		Has this proposal been agreed with the Highway Authority?
Will that part of the SuDS be adopted?		Agree adoption requirement with the Highway Authority or detail maintenance agreement in Section 12.

9. Additional considerations to comply with the Technical Standards and PPG

	Evidence / **Location of evidence – document and page no**	**Notes for developers & Local Authorities**
Which SuDS elements have been used? **Are there alternative more suitable SuDS solutions for the site?**	Permeable paving, soakaway and filter drains	SuDS can be adapted for most situations even where infiltration isn't feasible e.g. impermeable liners beneath some SUDS devices allows treatment but not infiltration. See CIRIA SUDS Manual C753 or equivalent.
How will exceedance events be catered on site without increasing flood risks (both on site and outside the development)?	External yard levels designed to fall away from building.	**Safely:** not causing property flooding or posing a hazard to site users i.e. no deeper than 300mm on roads/footpaths
How are rates being restricted?	Hydrobrake and Orifice to 2 L/S	Hydrobrakes must not be used for flow rates lower than 5 l/s. Pipes with flows < 5 l/s are prone to blockage.
Drainage during construction period	TBC	Provide details of how drainage will be managed during the construction period including any necessary connections, impacts, diversions, erosion control, and what measures will be put in place to prevent pollution.
Key Drainage components / Features and Consequences	Refer to exceedance flow arrows shown on drainage drawing	Which component if blocked (even partial) will lead to flooding and how will that be managed? Where will the exceedance flows go?
Level of treatments provided if required	Filter drains and Petrol Interceptor	Depending on diffuse pollution risk from the proposed sites, adequate level of treatment is required to mitigate against pollution

Technical Standards S10 to S12

10. Management and Maintenance of SuDS – Details are required to be provided of the management and maintenance plan for the SuDS, including for the individual plots in perpetuity.

	Evidence / Location of evidence – document and page no	**Notes for developers & Local Authorities**
How is the entire drainage system to be maintained in perpetuity? **Please provide Maintenance Plan and Regime for the site.** **Include how maintenance is to be recorded.**	Refer to maintenance plan	Clear details of the maintenance proposals of all elements of the proposed drainage system must be provided to show that all parts of SuDS are effective and robust. Provide a management plan to describe the SuDS scheme and set out the management objectives for the site. It should consider how the SuDS will perform and develop over time anticipating any additional maintenance tasks to ensure the system continues to perform as designed. — Specification notes that describe how work is to be undertaken and the materials to be used. — A maintenance schedule describes what work is to be done and when it is to be done using frequency and performance requirements as appropriate. — A site plan showing maintenance areas, control points and outfalls. Responsibility for the management and maintenance of each element of the SuDS scheme will also need to be detailed within the Management Plan. Where open water is involved please provide a health and safety plan within the management plan. A proposed method for recording maintenance activities must also be produced.
Please confirm the owners/adopters of the entire drainage systems throughout the development. Please list all the owners.	Owners TBC	If these are multiple owners then a drawing illustrating exactly what features will be within each owner's remit must be submitted with this Pro-forma. Please give details of each feature and how it will be managed in accordance with the details in the management plan.
Please provide details demonstrating that any third party agreements required using land outside the application site have been secured.	N/A	

The above form should be completed using evidence from information which should be appended to this form. The information being submitted should be proportionate to the site conditions, flood risks and magnitude of development. It should serve as a summary of the drainage proposals and should clearly show that the proposed discharge rate and volume as a result of development will not be increasing. Where there is an increase in discharge rate or volume, then the relevant section of this form must be completed with clear evidence demonstrating how the requirements will be met.

This form is completed using factual information and can be used as a summary of the surface water drainage strategy on this site.

Form completed by: Sufful Nowbuth……………………………………………………………………………………

Qualification of person responsible for signing off this pro-forma: Associate - MSc IEng MCIHT……………………………...

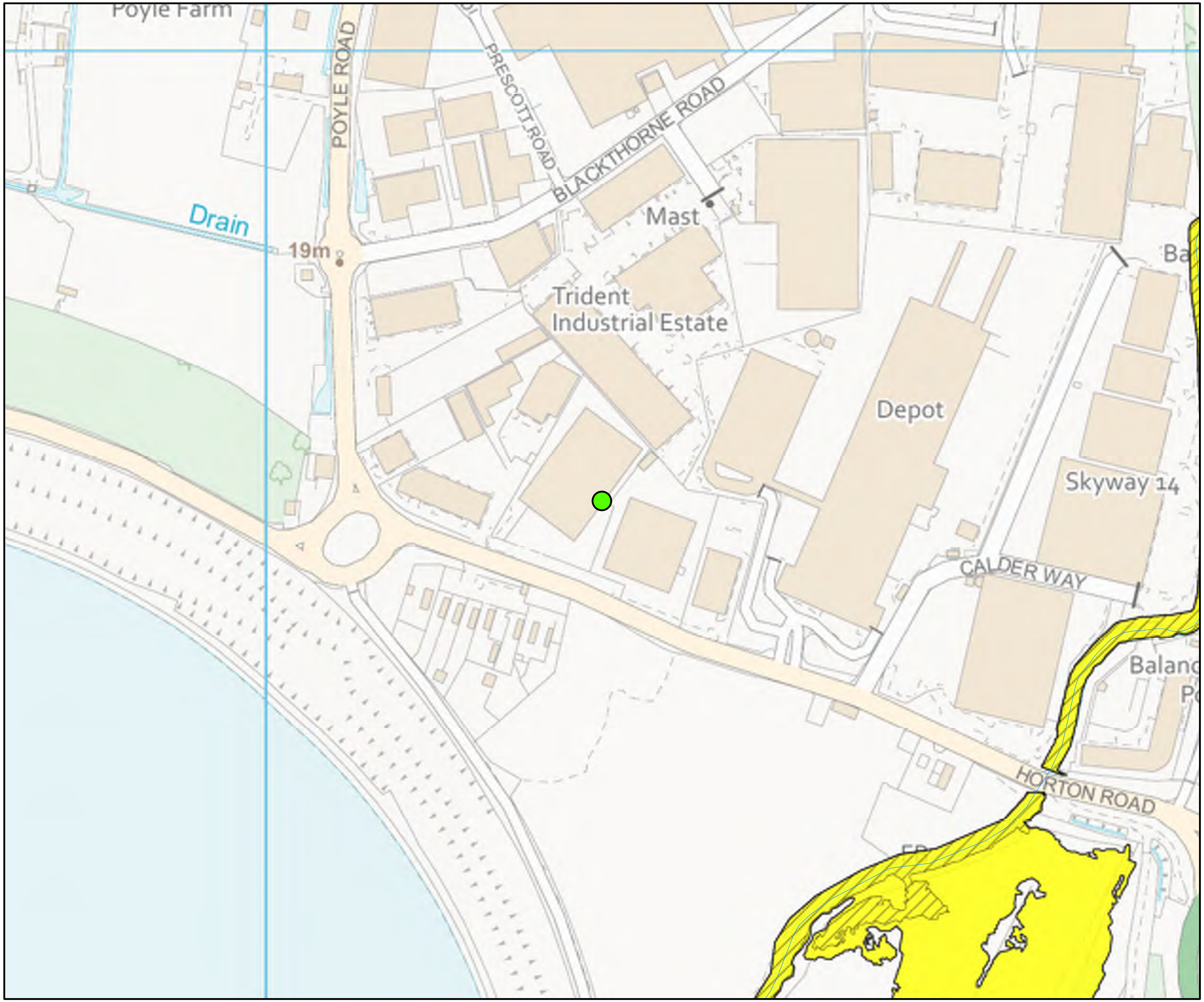
Company: Burrows Graham…………………………………………………………………………………………..

On behalf of (client's details):……………………………………………………………………………………….

Date: 06/04/2023……………………………………………………………………………………………...

APPENDIX I – EA PRODUCT 4 FLOOD DATA

Detailed FRA centred on: Horton Road, Poyle, Slough, SL3 0DF - 12/04/2023 - HNL 306367 JH



Environment Agency

Environment Agency
Alchemy,
Bessemer Road,
Welwyn Garden City,
Hertfordshire,
AL7 1HE

N

0 50 100 200
Metres

Legend

Statutory Main Rivers

Site location

Defended Flood Outlines

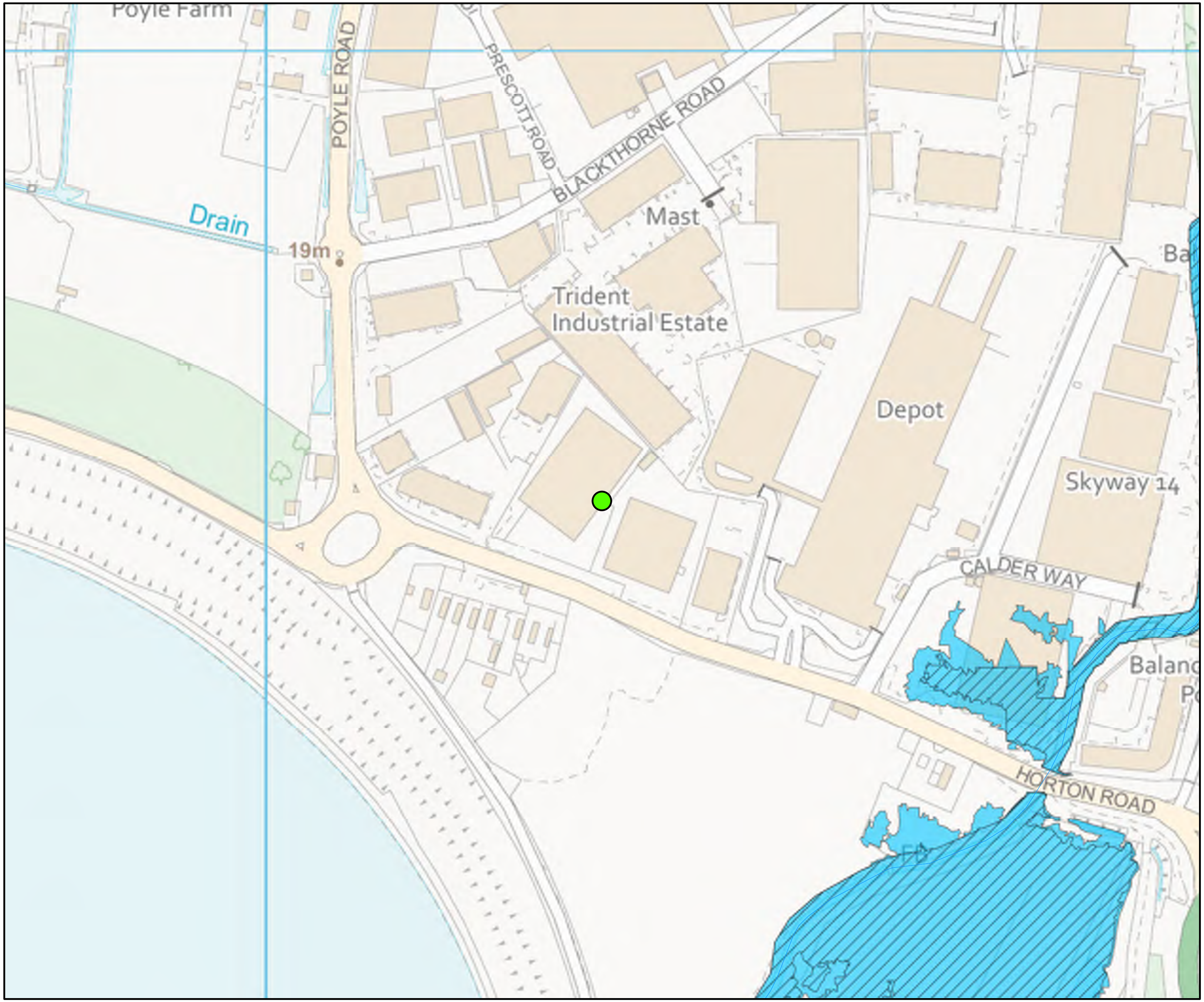
1 in 2 (50%) Defended

1 in 5 (20%) Defended

The data in this map has been extracted from the Lower Colne Modelling and Mapping Study (Mott MacDonald 2012).
This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences.
Flood risk data requests including an allowance for climate change will be based on the 1 in 100 flood plus 20% allowance for climate change, unless otherwise stated. You should refer to 'Flood risk assessments: climate change allowances' to check if this allowance is still appropriate for the type of development you are proposing and its location. You may need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.
https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Produced by:
Partnerships & Strategic Overview,
Hertfordshire & North London

Detailed FRA centred on: Horton Road, Poyle, Slough, SL3 0DF - 12/04/2023 - HNL 306367 JH



Environment Agency
Alchemy,
Bessemer Road,
Welwyn Garden City,
Hertfordshire,
AL7 1HE

N

0 50 100 200
Metres

Legend

Statutory Main Rivers

Site location

Defended Flood Outlines

1 in 10 (10%) Defended

1 in 20 (5%) Defended

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Produced by:
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Hertfordshire & North London

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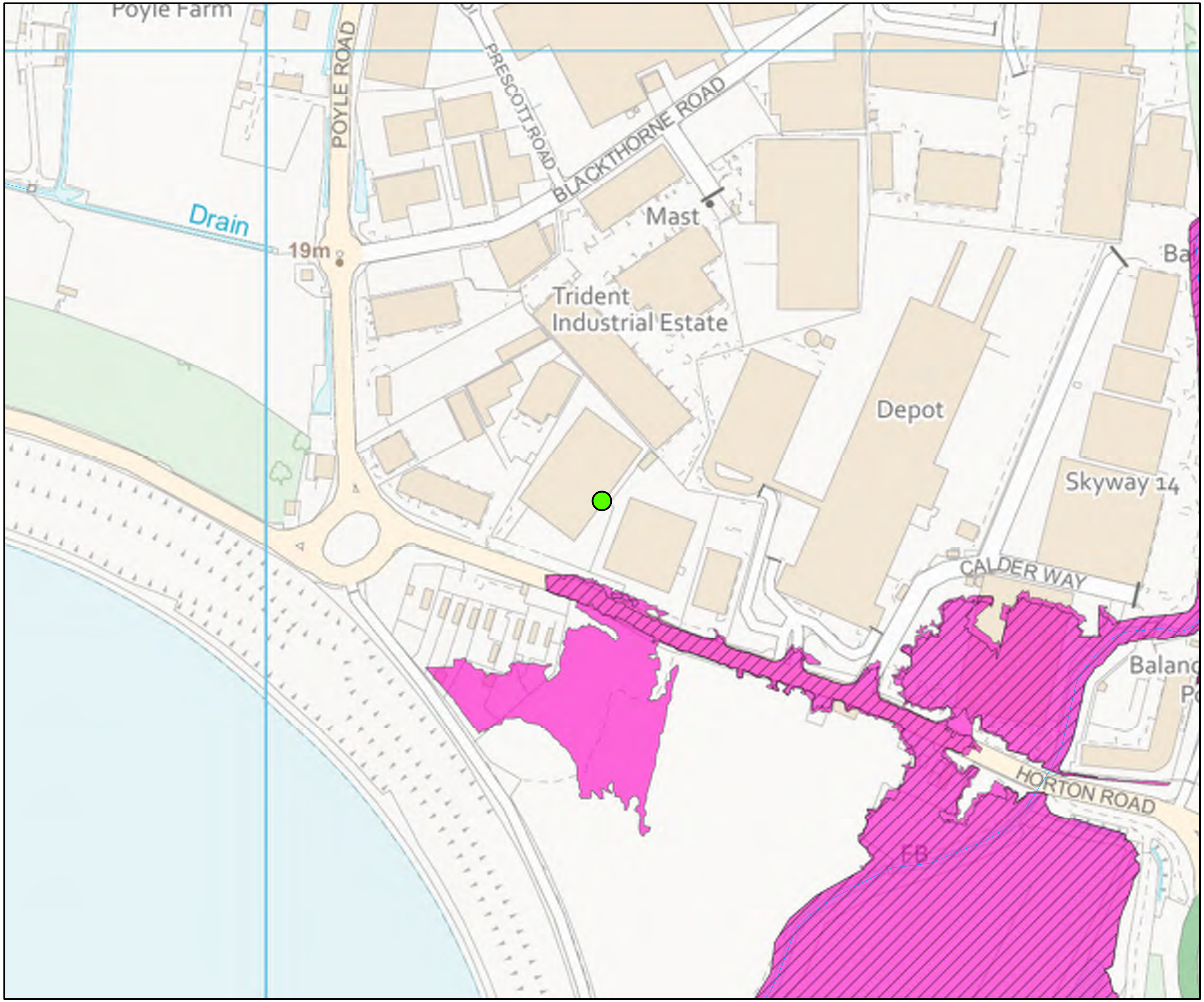

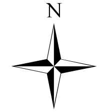

Environment Agency
Alchemy,
Bessemer Road,
Welwyn Garden City,
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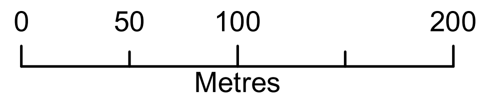
AL7 1HE



Legend

Statutory Main Rivers

Site location

Defended Flood Outlines

1 in 50 (2%) Defended

1 in 100 (1%) Defended

The data in this map has been extracted from the Lower Colne Modelling and Mapping Study (Mott MacDonald 2012).
This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences.
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https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Produced by:
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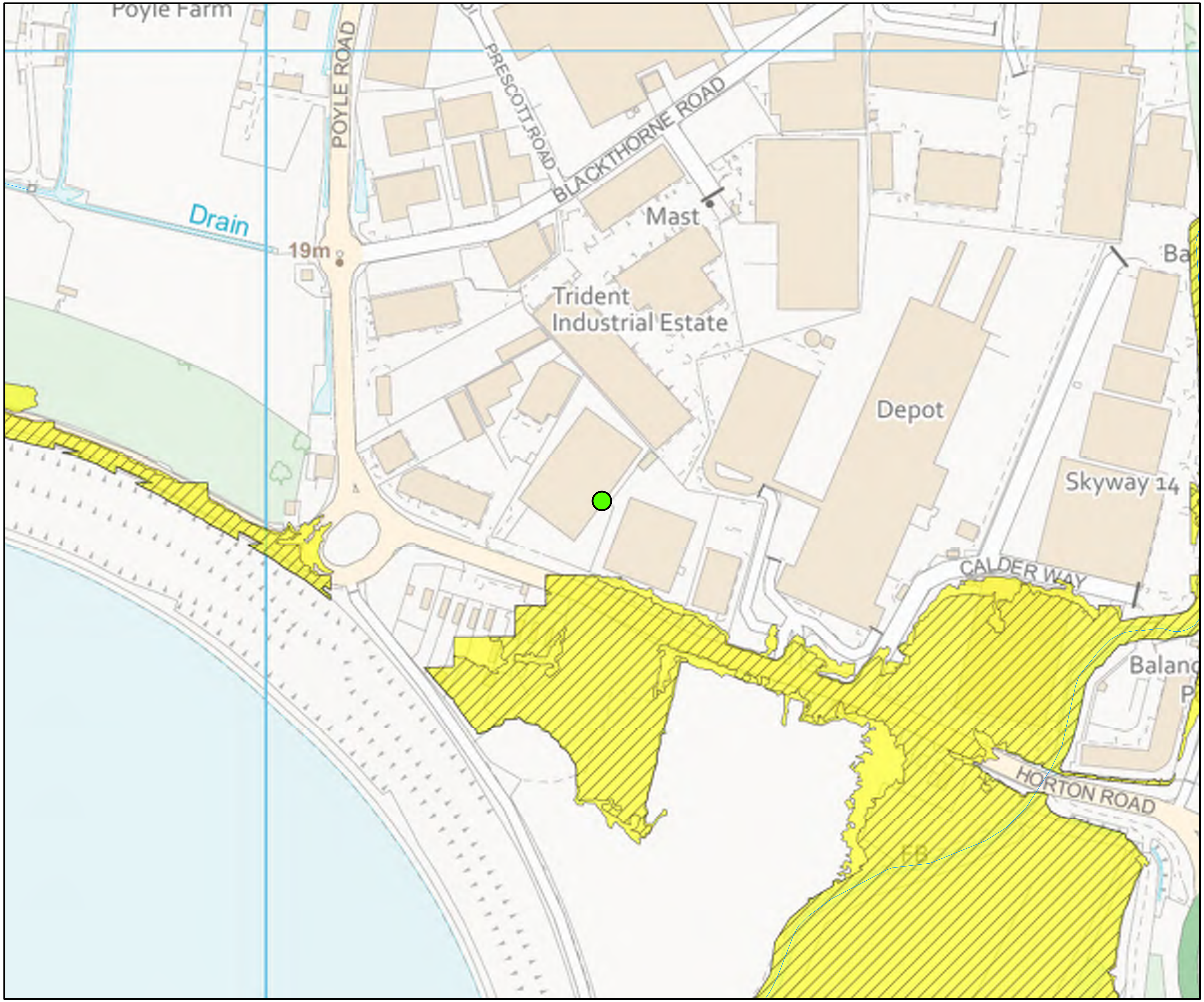
Hertfordshire & North London

Detailed FRA centred on: Horton Road, Poyle, Slough, SL3 0DF - 12/04/2023 - HNL 306367 JH



Environment Agency
Alchemy,
Bessemer Road,
Welwyn Garden City,
Hertfordshire,
AL7 1HE

N

0 50 100 200

Metres

Legend

Statutory Main Rivers

Site location

Defended Flood Outlines

1 in 100+20% (*CC) Defended

1 in 1000 (0.1%) Defended

The data in this map has been extracted from the Lower Colne Modelling and Mapping Study (Mott MacDonald 2012).

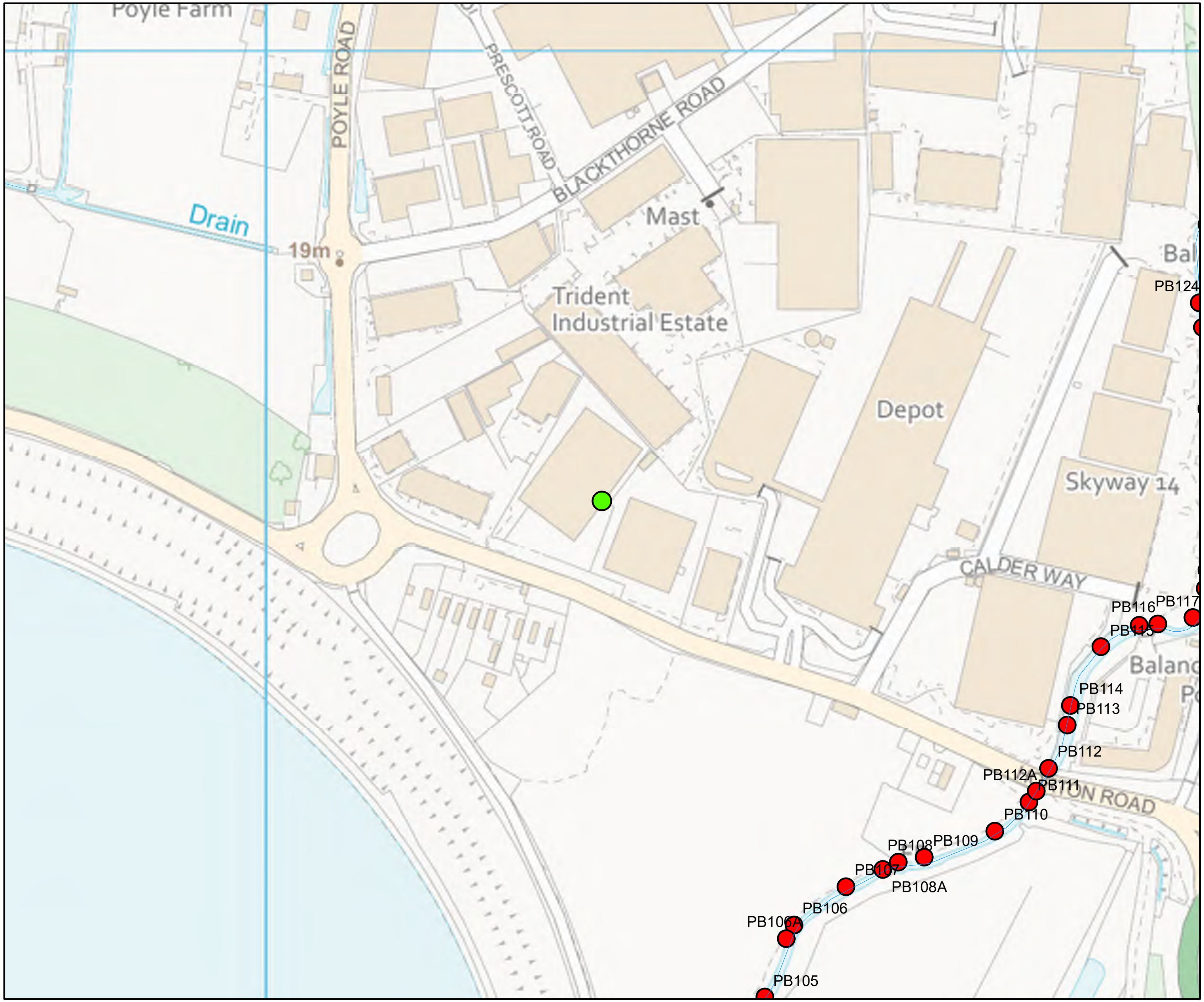
This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences.

Flood risk data requests including an allowance for climate change will be based on the 1 in 100 flood plus 20% allowance for climate change, unless otherwise stated. You should refer to 'Flood risk assessments: climate change allowances' to check if this allowance is still appropriate for the type of development you are proposing and its location. You may need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.

https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Produced by:
Partnerships & Strategic Overview,
Hertfordshire & North London

Detailed FRA centred on: Horton Road, Poyle, Slough, SL3 0DF - 12/04/2023 - HNL 306367 JH



Environment Agency
Alchemy,
Bessemer Road,
Welwyn Garden City,
Hertfordshire,
AL7 1HE

N

0 50 100 200
Metres

Legend

Statutory Main Rivers

Site location

1D Node Results

Node Results

The data in this map has been extracted from the Lower Colne Modelling and Mapping Study (Mott MacDonald 2012).
This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences.

Flood risk data requests including an allowance for climate change will be based on the 1 in 100 flood plus 20% allowance for climate change, unless otherwise stated. You should refer to 'Flood risk assessments: climate change allowances' to check if this allowance is still appropriate for the type of development you are proposing and its location. You may need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.
https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Produced by:
Partnerships & Strategic Overview,
Hertfordshire & North London

Environment Agency ref: HNL 306367 JH

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All flood levels are given in metres Above Ordnance Datum (mAOD)
All flows are given in cubic metres per second (cumecs)

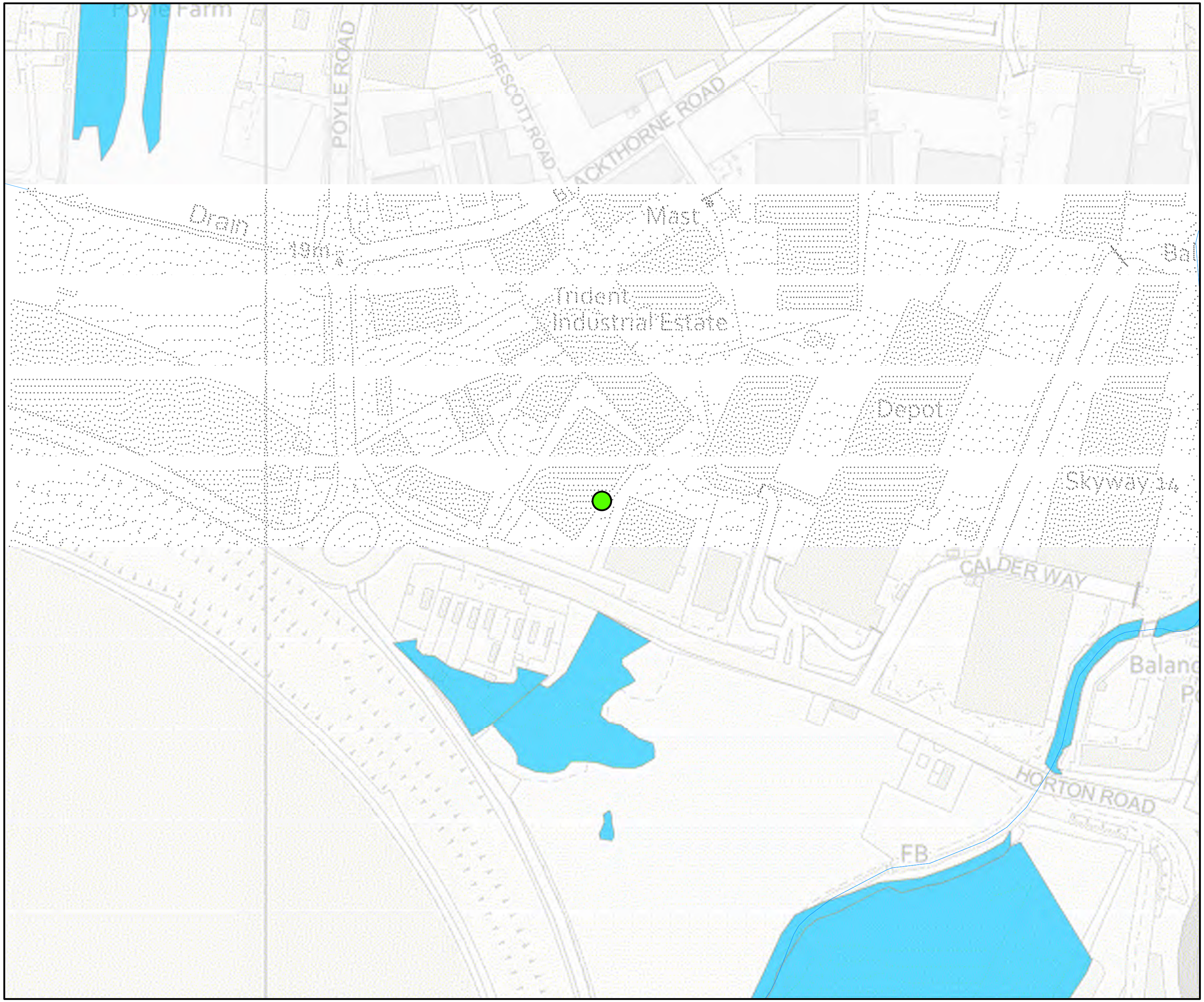
MODELLED FLOOD LEVEL

			Return Period							
Node Label	**Easting**	**Northing**	**2 yr**	**5 yr**	**10 yr**	**20 yr**	**50 yr**	**100 yr**	**100 yr + 20%**	**1000 yr**
PB104	503294	175354	18.72	18.88	18.98	19.06	19.11	19.14	19.18	19.25
PB105	503325	175384	18.77	18.94	19.03	19.1	19.15	19.17	19.21	19.27
PB106	503344	175431	18.85	19.12	19.32	19.47	19.55	19.61	19.68	19.79
PB106A	503339	175422	18.82	19	19.09	19.14	19.18	19.2	19.23	19.28
PB107	503378	175456	18.88	19.13	19.33	19.47	19.56	19.61	19.68	19.79
PB108	503412	175472	18.92	19.15	19.33	19.48	19.57	19.63	19.71	19.84
PB108A	503402	175467	18.92	19.15	19.33	19.47	19.56	19.61	19.68	19.79
PB109	503429	175475	18.97	19.16	19.34	19.48	19.57	19.64	19.71	19.84
PB110	503475	175492	19.11	19.27	19.39	19.5	19.59	19.64	19.72	19.84
PB111	503497	175511	19.19	19.37	19.46	19.56	19.64	19.7	19.77	19.88
PB112	503510	175533	19.26	19.47	19.59	19.7	19.78	19.84	19.91	20.02
PB112A	503502	175518	19.26	19.47	19.59	19.69	19.77	19.83	19.9	19.99
PB113	503522	175561	19.27	19.49	19.61	19.73	19.81	19.87	19.94	20.05
PB114	503524	175574	19.27	19.49	19.62	19.73	19.81	19.87	19.94	20.05
PB115	503544	175612	19.28	19.5	19.63	19.75	19.83	19.89	19.97	20.07
PB116	503581	175627	19.3	19.53	19.67	19.78	19.86	19.92	20	20.1
PB116A	503569	175626	19.3	19.53	19.66	19.78	19.86	19.92	19.99	20.09
PB117	503604	175631	19.31	19.54	19.67	19.78	19.87	19.93	20	20.11
PB118	503612	175650	19.32	19.55	19.68	19.8	19.88	19.94	20.01	20.12
PB119	503613	175662	19.33	19.56	19.69	19.81	19.89	19.95	20.02	20.13
PB120	503614	175675	19.34	19.57	19.7	19.82	19.9	19.96	20.03	20.14
PB121	503615	175720	19.38	19.61	19.75	19.86	19.94	20	20.08	20.19
PB122	503613	175767	19.44	19.67	19.81	19.91	19.99	20.05	20.13	20.23
PB123	503610	175820	19.49	19.72	19.86	19.96	20.03	20.09	20.16	20.27
PB124	503608	175836	19.51	19.74	19.89	19.98	20.05	20.11	20.18	20.29
PB125	503613	175887	19.56	19.79	19.93	20.02	20.09	20.15	20.23	20.33
PB126	503638	175892	19.6	19.82	19.96	20.06	20.14	20.19	20.27	20.38
PB126A	503622	175888	19.59	19.82	19.96	20.05	20.12	20.18	20.25	20.36
PB127	503641	175895	19.6	19.81	19.96	20.06	20.14	20.2	20.27	20.39
PB128	503667	175936	19.66	19.87	20	20.1	20.17	20.22	20.3	20.4

MODELLED FLOWS

			Return Period							
Node Label	Easting	Northing	2 yr	5 yr	10 yr	20 yr	50 yr	100 yr	100 yr + 20%	1000 yr
PB104	503294	175354	2.33	3.91	5.12	6.21	6.96	7.57	8.46	10.17
PB105	503325	175384	2.34	3.91	5.03	5.87	6.37	6.77	7.32	8.34
PB106	503344	175431	2.34	3.91	4.91	5.42	5.59	5.71	5.83	5.95
PB106A	503339	175422	2.34	3.91	4.91	5.42	5.59	5.71	5.83	5.95
PB107	503378	175456	2.35	3.92	4.92	5.42	5.6	5.71	5.83	5.97
PB108	503412	175472	2.35	3.93	4.94	5.42	5.58	5.65	5.71	5.75
PB108A	503402	175467	2.35	3.93	4.94	5.42	5.58	5.65	5.71	5.75
PB109	503429	175475	2.3	3.74	4.68	5.26	5.7	5.95	6.17	6.29
PB110	503475	175492	2.36	3.94	5.16	6.21	6.99	7.62	8.39	9.31
PB111	503497	175511	2.36	3.94	5.17	6.21	7	7.64	8.44	9.44
PB112	503510	175533	2.36	3.94	5.17	6.21	7	7.64	8.46	9.54
PB112A	503502	175518	2.36	3.94	5.17	6.21	7	7.64	8.46	9.54
PB113	503522	175561	2.36	3.94	5.17	6.21	7	7.64	8.46	9.54
PB114	503524	175574	2.36	3.95	5.17	6.21	7	7.64	8.46	9.54
PB115	503544	175612	2.36	3.95	5.17	6.21	7	7.65	8.49	9.68
PB116	503581	175627	2.37	3.95	5.17	6.21	7	7.65	8.57	10
PB116A	503569	175626	2.37	3.95	5.17	6.21	7	7.65	8.57	10
PB117	503604	175631	2.37	3.95	5.17	6.21	7	7.65	8.57	10
PB118	503612	175650	2.37	3.95	5.17	6.21	7	7.65	8.57	10.07
PB119	503613	175662	2.37	3.95	5.17	6.21	7	7.65	8.57	10.07
PB120	503614	175675	2.37	3.95	5.17	6.21	7	7.65	8.57	10.07
PB121	503615	175720	2.37	3.95	5.17	6.21	7	7.65	8.57	10.07
PB122	503613	175767	2.38	3.95	5.17	6.21	7	7.65	8.57	10.07
PB123	503610	175820	2.38	3.95	5.17	6.21	7	7.65	8.57	10.07
PB124	503608	175836	2.38	3.95	5.17	6.21	7	7.65	8.57	10.07
PB125	503613	175887	2.39	3.95	5.17	6.21	7	7.65	8.57	10.07
PB126	503638	175892	2.39	3.96	5.17	6.21	7	7.65	8.57	10.07
PB126A	503622	175888	2.39	3.96	5.17	6.21	7	7.65	8.57	10.07
PB127	503641	175895	2.39	3.96	5.17	6.21	7	7.65	8.57	10.07
PB128	503667	175936	2.39	3.96	5.17	6.21	7	7.65	8.57	10.07

Historic Flood Map centred on: Horton Road, Poyle, Slough, SL3 0DF - 12/04/2023 - HNL 306367 JH



Environment Agency

Environment Agency
Alchemy,
Bessemer Road,
Welwyn Garden City,
Hertfordshire,
AL7 1HE

N

0 50 100 200
Metres

Legend

Statutory Main Rivers

Site location

Flood Event Outlines

2003

The historic flood event outlines are based on a combination of anecdotal evidence, Environment Agency staff observations and survey.
Our historic flood event outlines do not provide a definitive record of flooding.
It is possible that there will be an absence of datain places where we have not been able to record the extent of flooding.
It is also possible for errors occur in the digitisation of historic records of flooding.

Produced by:
Partnerships & Strategic Overview,
Hertfordshire & North London