

Birch Business Park, Heywood

Flood Risk Assessment

CGG MLI (REIT) Propco 1 Limited



Quality Control

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Revision History

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1. Introduction

I&L Consulting Limited (I&L) was commissioned by the Applicant, CGG MLI (REIT) Propco 1 Limited, to undertake a Flood Risk Assessment (FRA) for a proposed industrial development located in an existing industrial area known as Birch Business Park, Heywood. The site lies within the authority of Rochdale Borough Council (RBC).

The relevant national planning guidance is set out by the National Planning Policy Framework (NPPF, updated in 2025). An FRA must assess all sources of flood risk both to the proposed development itself and the potential impact on people and property elsewhere within the catchment.

1.1 Study Aims and Objectives

The overall objective of this study was to carry out an FRA that meets the requirements of the NPPF and RBC flood risk policies. These consider surface water runoff management and the specific needs of the Environment Agency (EA), RBC and United Utilities. The study is required to assess all aspects of flood risk to the proposed development, the potential impacts of the development on people and property elsewhere within the catchment and identify possible mitigation measures to ensure that the development is safe in the event of a flood. To achieve this aim, the following key actions were undertaken:

- Obtain flood data from the EA and RBC.
- Review topographical and flood risk data to identify the existing flood risk posed to the site from all sources.
- Assess the residual flood risk post-development.
- Consider the vulnerability of the users and the development, taking account of the vulnerability classification;
- Assess the safety of the route of access/egress from the site in a flood event;
- Identify suitable mitigation measures to protect the development site against flooding; and
- The production of a conceptual surface water drainage strategy for the proposed development.

1.2 Scope of Works

In order to meet the above objectives, the following scope of work and tasks were undertaken:

- **Task 1: Data Collection.** I&L Consulting collected relevant available information on the nature of the flooding at the site. The Applicant and their consultant team have provided information about the site and proposed development layout and design.
- **Task 2: Identification of Current and Post-Development Flood Risk.** The existing and post-development flood risk posed to the site was assessed from the data that was collected in Task 1. The assessment identifies the flood risk from all potential sources of flooding and includes consideration of the impact of climate change on flood risk.
- **Task 3: Assessment of Site Safety.** I&L Consulting considered whether flood resilience measures needed to be undertaken and the safety of the route of access/egress from the site.

1.3 Data Collected

Table 1 lists the data that has been collected as part of this assessment. Comments on the source and the nature of the data are also provided.

Table 1: Collected Data

Purpose	Data and Source	Comments
Identification of site location	Ordnance Survey Map	Identifies the position of the site and local hydrological features
Identification of flood risk	Environment Agency Flood Map	Risk of flood from tidal and fluvial sources
	Topographical Survey	Existing site levels and topography
	Development details (drawings for existing site and proposed development)	Information on the layout of the proposed development
	Strategic Flood Risk Assessment (SFRA)	Reports that identify existing flood risk information within the area and considerations for development.
Identification of the existing drainage network	Sitewide Drainage Plan	Asset plans and drainage drawings identify public and private sewers nearest to the site.
Identification of ground conditions	British Geological Society (BGS)	Identifies the type of aquifer, groundwater level, permeability and geotechnical information
	BH Logs and site investigation reports	

2. Planning Policy and Evidence

2.1 National Planning Policy Framework

The NPPF sets out what needs to be taken into account by developers to assess whether a proposed development is likely to be at risk of flooding or has the potential to increase flood risk elsewhere.

The overall objective of the NPPF is to steer development towards areas of lowest flood risk. NPPF policy aims to ensure flood risks have been taken into account and appropriate measures put in place to ensure that:

- The development is safe;
- Where possible, the flood risk overall is reduced;
- Increased flood risk does not occur elsewhere; and
- Appropriate mitigation measures are employed to deal with these effects and risks.

NPPF outlines that a site-specific flood risk assessment is required for proposals of 1 hectare or greater in Flood Zone 1; all proposals for new development (including minor development and change of use) in Flood Zones 2 and 3, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the Environment Agency); and where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

The EA Flood Map shows the site to be located within Flood Zone 1 and greater than 1 ha.

The NPPF considers the vulnerability of different forms of development to flooding; and classifies the proposed development as 'Less Vulnerable'.

2.2 Strategic Flood Risk Assessment

In March 2009, JBA Consulting was commissioned by Bury Metropolitan Borough Council, Rochdale Metropolitan Borough Council and Oldham Metropolitan Borough Councils to undertake a Level 1 and Level 2 Strategic Flood Risk Assessment (SFRA) leading on from the Greater Manchester Sub-Regional SFRA completed in August 2008. The purpose of the SFRA is to assess and map all known sources of flood risk including fluvial, surface water, sewer, groundwater and all impounded water bodies, taking into account future climate change predictions.

A summary of the main elements from the SFRA associated with the development site is detailed below. The full report can be found on the Rochdale Metropolitan Borough Council Website.

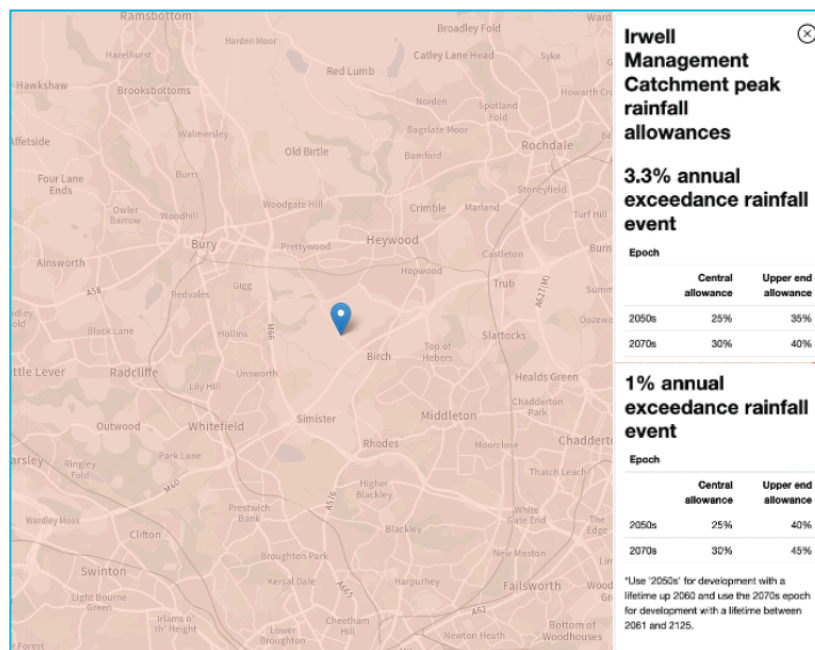
- SFRA provides a detailed understanding of flood risks across the borough from all sources.
- The main source of flood risk in Rochdale is fluvial flooding from the River Roch. The majority of flood defences along the River Roch are in good condition, providing a 1 in 100 year Standard of Protection to adjacent areas. During detailed modelling which included improved hydrological estimation, it was found that these defences also managed the 1 in 100 year plus climate change event, albeit with a reduced freeboard or factor of safety.
- There are a number of locations along Buckley Brook in Rochdale where defences are at a lower standard and are at risk of overtopping in the 1 in 100 year event. The immediate hazard is relatively small, however during larger events, flood flow paths form, placing a number of key residential and proposed development sites at greater risk.
- Flood risk management strategies have been discussed in Rochdale, identifying the need to improve the quality of defences along Buckley Brook to reduce the impact of defences overtopping and the possibility of leaving proposed development sites upstream of central Rochdale open for flood storage.

- The River Roch catchment in Rochdale is relatively steep, which tends to promote surface water flooding. This is a particular problem in Littleborough and Heywood, both of which have been identified as Critical Drainage Areas.
- There are relatively few reported incidents of groundwater flooding in Bury, Rochdale and Oldham.
- Development should be designed so that there is no flooding to the development in a 1 in 30- year event and so that there is no property flooding in a 1 in 100 year plus climate change event Where possible SUDS should be implemented.
- Guidance would request a 50% reduction in existing brownfield discharge rates.

2.3 Climate Change

Predicted future change in peak river flows caused by climate change are provided by the EA within their online guidance¹. The UK has been split into a series of regionalised 'River Basin Districts'. These River Basin Districts are further split into Management Catchments, for which a range of climate change projections have been applied.

The Proposed Development falls within the Irwell Management Catchment. The extract below identifies the relevant peak rainfall allowances from this Management Catchment.



When determining the appropriate allowance for use in an FRA the anticipated lifespan of the development should be considered. This Proposed Development is expected to have a design life which goes beyond 2060.

The EA guidance is to use the central allowance for the 2070s epoch (2061 to 2125), which gives values of 30% for the 3.3% (30yr) and 30% for the 1% (100yr) rainfall events. The value of **30%** has been used in the surface water calculations appended to this report.

¹ Environment Agency, Flood risk assessments: climate change allowances: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#table-1>

3. Site Description

The proposed development site which is the subject of this Flood Risk Assessment (FRA) is situated in Birch Industrial Park. The Park is accessed off Moss Hall Road in Heywood which is located between Rochdale to the northeast and Manchester to the south.

The proposed development will consist of a single industrial unit with associated parking and HGV turning and dock leveller areas. The total development site is generally flat with a total site area of 2.18Ha.

This Section 73 application seeks to vary Planning Permission 24/00453/VRCON approved on 12 July 2024. The proposed amendments seek to increase the floorspace of the approved unit and make various other minor changes to the layout and elevations. Planning Permission 24/00453/VRCON has been lawfully implemented in accordance with Section 56 of the Town and Country Planning Act and is therefore extant. This fallback position is a material consideration in the determination of these amended proposals.

The site is classified as brownfield with a large warehouse and separate building block plus associated external areas of roads, parking and service yard. The site has recently been demolished.

An underground utility scan of the site has identified existence of a surface water drainage network and interceptor. See **Appendix A**.

The United Utilities asset map does not show any sewers local to the site. See **Appendix B**.

The proposal would be to drain the developed sites' surface water runoff at a restricted rate into the existing private surface water drainage network that serves the industrial park, see **Appendix D**.

The site location plan is shown in Figure 1 below.



Figure 1: Site Location Plan

3.1 Topography and Hydrological Setting

Environment Agency (EA) river mapping shows that the nearest 'main river' is Whittle Hill Brook 0.5km to the east and Whittle Brook 1km to the south. There is an existing watercourse along the eastern boundary of Birch Business Park.

The topographic survey (**Appendix A**) indicates that the site levels generally lie between 131.00m AOD and 132.00m AOD southeast of the site.

3.2 Geology and Hydrogeology

A Phase II Ground Investigation Report dated March 2022 has been completed by Applied Geology prior to demolition. Results from the site-specific intrusive investigations can be summarised as follows:

Stratum	Depth to Top of Strata (m bgl)	Thickness (range) (m)	Comments
Hardstanding	GL	0.2 – 0.4	Encountered at locations CP3 and CP4 as asphalt and concrete.
Topsoil & Made Ground/Topsoil	GL	0.2 – 0.4	Encountered at the perimeter of the site.
Made Ground	GL – 0.4	0.3 – 3.45	Generally, to depths of between 0.35m and 1.1m bgl. Deepest in CP4 at 3.6m bgl.
Glaciofluvial Ice Contact Deposits	0.2 – 1.4	0.3 – 15.25	Encountered at all exploratory hole locations. Thickest in CP2, CP3, and CP5.
Glacial Till	1.4 - 3.6	0.6 - 8.6	Encountered only at exploratory hole locations CP1, CP4, CP5, DCS1 and DCS5. Significantly thicker in CP1 and CP4.

Ground conditions

The site has been demolished and stripped of all impermeable surfacing. The demolished material has been crushed, spread and compacted across the site and stockpiled in locations to the north of the site. Made ground exists up to 3.45m beneath the compacted rubble.

Hydrogeology

Groundwater was encountered during intrusive investigations. Resting groundwater levels were recorded during the wet months of January and March at 0.73m (129.38m AOD) and 2.50m (130.99m AOD) below pre-demolished ground levels.

Superficial Glaciofluvial Ice Contact Deposits are classified as a Secondary 'A' Aquifer. The underlying Glacial Till is classified as a Secondary 'Undifferentiated' Aquifer.

The site is not located within a Source Protection Zone (SPZ).

4. Existing Flood Risk

This section of the report identifies the existing risks from the different forms of flooding identified in NPPF.

4.1 Fluvial & Tidal Flooding

The EA has produced Flood Zone maps for much of England and Wales. The current displayed map is reproduced as Figure 2 below and shows the site to lie in Flood Zone 1 (low risk).

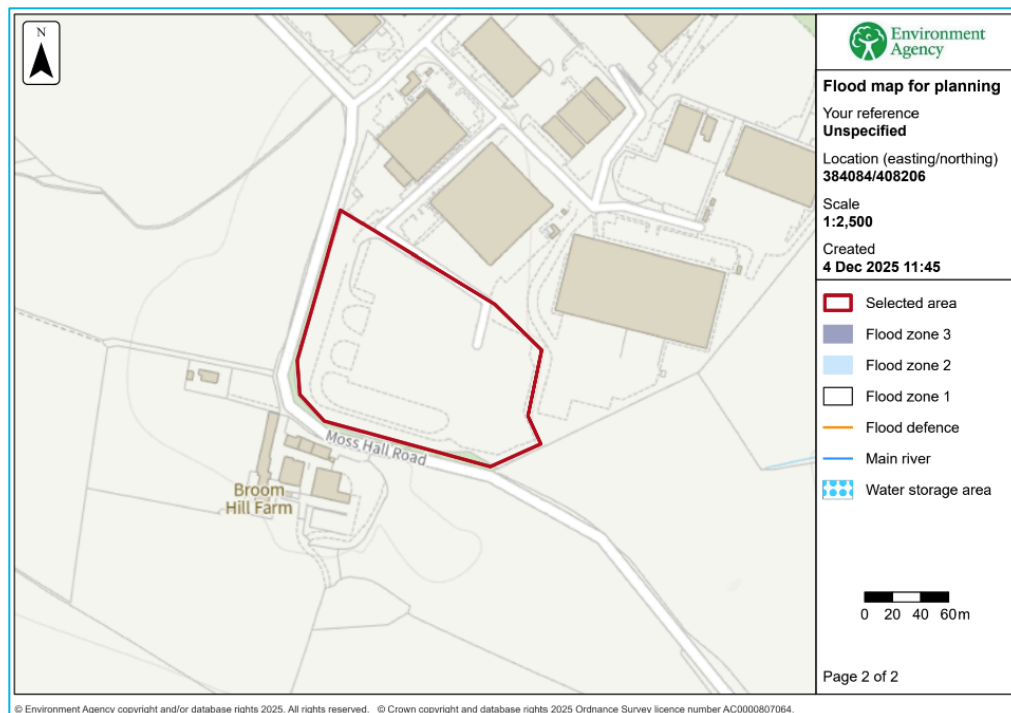


Figure 2: EA Flood Map for Planning (Source: <https://flood-map-for-planning.service.gov.uk/>)

On the coast storm surges and high tides can threaten low lying coastal areas and can be sometimes large and rapid enough to overtop defence works, causing significantly more damage than river flooding. Tidal flooding is not considered a risk to the site due to the inland location of the development.

Therefore, flood risk from fluvial and tidal sources to the site is considered to be low.

4.2 Surface Water Flooding

Surface water flooding occurs when rainfall is unable to infiltrate into the ground and/or inundates substandard engineered drainage networks and accumulates on the surface. This flooding mechanism can occur almost anywhere but is likely to be of particular concern in any topographical low spot, or where the pathway for runoff is restricted by terrain or man-made obstructions.

The risk of flooding from surface water is presented in the GOV.UK online map at a strategic scale. It can be seen from the surface water flood map in Figure 3 that the site is shown to have an isolated area of ponding to the west. This is based on the pre-demolished site layout and corresponded with an area of lower levels. This ponding shall be removed with the re-developed sites' re-designed levels and drainage network.

There are no existing surface water flow routes through the site that would need to be maintained.

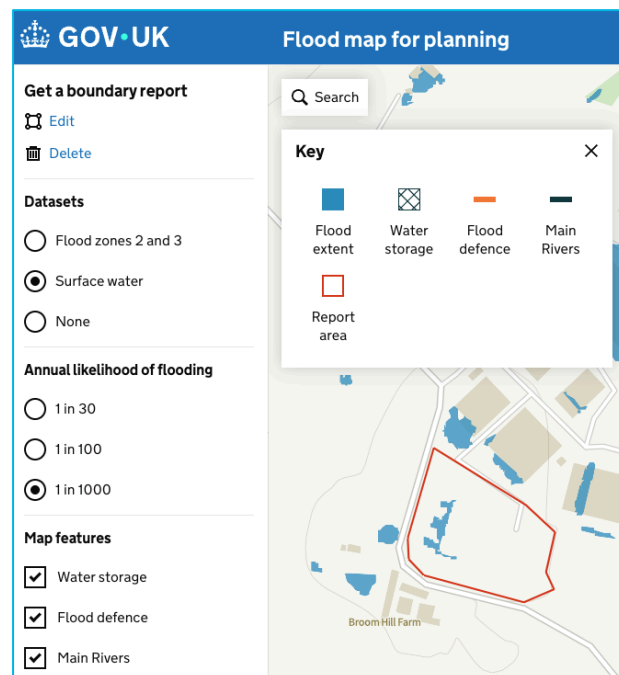


Figure 3: Surface Water Flood Risk Map (Source: <https://flood-warning-information.service.gov.uk>)

The surface water from the proposed development will provide a betterment to the existing case by capturing all surface water runoff from roofs and external hardstanding. Peak flows shall also be reduced thereby eliminating this surface water flooding. The site will therefore be at a low risk from surface water flooding.

4.3 Groundwater Flooding

Groundwater flooding occurs because of water rising from an underlying aquifer or from water flowing from abnormal springs. This tends to occur after long periods of sustained high rainfall, and the areas of most risk are often low-lying where the water table is more likely to be at shallow depth.

The development site is underlain by a variable thickness of Made Ground. The majority of the site is underlain by Glacial Till and Pennine Lower Coal Measures Formation. These are both Secondary A Aquifers which are classified as permeable layers capable of supporting water supplies at a local scale, and in some cases forming an important source of base flow to rivers.

According to the SFRA information there are relatively few reported incidents of groundwater flooding in the area. FFLs will also be set at least 150mm above existing ground levels. We would therefore expect the risk from groundwater flooding at this site to be **low**.

4.4 Sewer Flooding

A sewer flood is often caused by surface water drains discharging into the combined sewer systems. Sewer capacity is exceeded in large rainfall events causing the backing up of floodwaters within properties or discharging through manholes. Most adopted surface water drainage networks are designed to the criteria set out in Sewers for Adoption. One of the design parameters is that sewer systems be designed such that no flooding of any part of the site occurs in a 1 in 30-year rainfall event. By definition a 1 in 100-year event would exceed the capacity of the surrounding sewer network as well as any proposed drainage.

To ensure that sewer and surface water flooding is not exacerbated; surface water must be considered within the design of the site. This ensures that any additional surface water and overland flows are managed correctly, to minimise flood risk to the site and the surrounding area.

The existing business park has a network of private drainage which is managed and maintained by a management company. Significant re-development has been occurring at the Business Park in recent years which has ensured all private drainage is designed and installed to current standards.

The site will have new surface and foul water connection points. The surface water discharge from the redeveloped site will be restricted therefore significantly improving the current situation

Therefore, the risk of sewer flooding to the site is considered **low**.

4.5 Artificial Sources of Flooding

There are no canals or reservoirs in close proximity to the site. Therefore, the risk of flooding from artificial sources is considered to be diminished to acceptable levels, removing the requirement for further investigation and assessment.

Therefore, the risk from this type of flooding can be considered **low**.

4.6 Summary of Existing Flood Risk

The flood risk from fluvial & tidal flooding, surface water flooding, sewer flooding and groundwater is assessed to be low.

The flood risk to the site is summarised in Table 2.

Table 2: Summary of flood risk to the Site

Type of Flooding	Source of Flooding	Existing Flood Risk
Fluvial and Tidal	Whittle Hill Brook & Whittle Brook	Low
Surface Water	Runoff from the site and surrounding land	Low
Sewers	Surrounding private drainage systems	Low
Ground Water	Underlying geology	Low
Artificial Sources	Reservoir	Low

5. Flood Risk from the Proposed Development

The proposed development will consist of a single industrial unit with associated parking and HGV turning and dock leveller areas. The total development site is generally flat with a total site area of 2.18Ha.

The proposed development drawing is included in **Appendix C**.

5.1 Fluvial and Tidal Flooding

The site is located within Flood Zone 1 and at low risk of fluvial flooding. The proposed development work would not have any impact on fluvial or tidal flooding. Therefore, the risk of flooding from fluvial and tidal sources has been assessed to remain low.

5.2 Surface Water Flooding

The site was brownfield and the utility scan shows evidence of underground drainage serving the existing site, see **Appendix A**. There is no existing surface water restriction in place for the existing impermeable portion of the site.

The surface water flood maps (Figure 3, above), shows the site was at risk of localised surface water flooding due to a low-lying area within the site. The surface water from this re-development will provide a betterment to the existing case by capturing all surface water runoff from roofs and areas of external hardstanding. Peak flows shall also be reduced thereby eliminating surface water flooding.

5.3 Proposed Drainage Strategy

Discharge to ground. The site consists of Made Ground comprising gravelly clayey sand and gravelly sandy clay between 0.3m and 3.45m below pre-demolished ground levels. Due to the thickness of Made Ground and the cohesive nature of it the subsoils are not conducive to infiltration.

Discharge to watercourse. There is an existing watercourse to the east of the site – the current private drainage system for the Business Park discharges into this watercourse.

Discharge to sewer. There are no public surface water sewers accessible from the site. There is an existing private drainage system that serves the wider industrial park and ultimately outfalls into the watercourse to the east.

Rochdale Borough Council SFRA states that a brownfield site development should provide a 50% reduction in pre development discharge rates

The impermeable area formally draining off the site has been estimated at 80% of the pre-demolished impermeable area of 11,650m². Hence existing flow from the site has been assessed on an area of 9,320m² and assuming a runoff coefficient of 0.85.

The proposed new development will be restricted to 58% reduction of the existing 30yr return period storm, thereby creating a significant betterment on the existing situation.

A comparison is provided in Table 3 below showing the percentage reduction in runoff rate proposed.

Table 3: Existing/Proposed Surface Water Runoff reduction

Storm Event	Existing(l/s)	Proposed(l/s)	Reduction (%)
Surface Water Runoff			
30yr storm	172	71	58%
100yr Storm	221	71	67%

The drainage has been designed to accommodate all storms up to and including the 100yr event, including a 30% allowance for climate change. **Appendix D** shows the proposed drainage strategy, and the **Appendix E** shows the corresponding drainage calculations.

The surface water drainage network for the proposed development is in line with the principles of integrated Construction Industry Research and Information Association (CIRIA) Sustainable Drainage System SuDS and source control methods to convey surface water runoff flows from the site as well as national and local standard.

- The site is a Brownfield site with existing drainage in place and no formal restrictions on discharge rates. The existing site is 80% impermeable.
- The proposal is to limit the discharge from the redeveloped site to 58% reduction of the existing site 30yr return period storm for all return periods, including climate change allowances.
- Appropriate attenuation to be provided onsite;
- The onsite surface water drainage design will follow the principles listed in the Approved Document Part H of the Building Regulations and Sewers for Adoption 7th Edition. The Building Regulations established a hierarchy for surface water disposal which encourages a SuDS approach;
- No surcharge for the 1:1year rainfall event except for the outfall pipe which may surcharge due to restriction.
- Onsite surface water sewers shall be designed to a 1 in 30 year no flooding standard in accordance with BS EN 752: 2017. There will be no flooding of buildings or off-site areas during a 1 in 100-year return period storm event including climate change allowance.
- Any onsite flooding in the 1:100+30% event, will be directed into a safe place or mitigation measures to be provided on site for any flooding over 5m³.

The proposed drainage network and attenuation requirements are modelled using industry standard hydraulic modelling software included in **Appendix E**. The controlled discharge will be made via the existing outfall of the site.

The proposed drainage layout is included in **Appendix D**.

Therefore, the risk of surface water flooding from the proposed development will remain low.

Previous Approval

The proposed drainage scheme has been carried out in general accordance with a previous scheme approved under Planning Ref. 24/00453/VRCON and listed in the associated condition 6. By Ridge Consultants (dated Sep 2021) as detailed in the Proposed Drainage GA drg ref. BUB-RDG-00-ZZ-DR-C-0501 Rev P5 (dated 12.5.22). **See Appendix F**.

As part of this S73 application it is proposed to vary condition 6 to allow approval of the amended drainage proposals.

Assessment of Surface Water Management Options

For sustainable management of surface water run-off from a new development, the use of SuDS is recommended. Table 5 provides a comparison of the different kinds of SuDS systems and their suitability for use at the development site.

5.4 Water Quality

Table 26.2 of the CIRIA C753 SuDS Manual identifies that the pollution hazard level associated with the land uses within the Proposed Development as being 'Medium'. On a scale from 0 – 1, 'Commercial Yard & delivery areas' are deemed to have the following pollution hazard indices:

- Total suspended solids = 0.7
- Metals = 0.6
- Hydrocarbons = 0.7

The SuDS Manual confirms that in England and Wales, where the destination of runoff is to a watercourse then surface water indices should be used for the surface water discharge (Table 26.3 of The SuDS Manual).

The proposed surface water drainage strategy discharges to an existing outfall to an overflow ditch/watercourse. Therefore, the use of the surface water indices approach is deemed to be appropriate.

In terms of pollution control the site it is proposed that the commercial yard and delivery areas are to be protected by Class 1 bypass petrol interceptor. The pollution mitigation assessment is summarised in Table 4 below. The pollution removal characteristics of the pollution control features are based on data in CIRIA C753 and data provided by the product manufacturers.

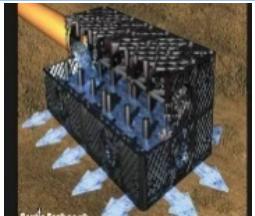
Table 4: Pollution Mitigation Assessment for the site

Type of SuDS component	Total suspended solids (TSS)	Metals	Hydrocarbons
Class 1 Bypass Petrol Interceptor (Kingspan or similar)	0.8*	0.6*	0.8*
Total	0.4	0.6	0.8

*based on SPEL products

The results in Table 4 show that there is a minor residual impact associated with the Total Suspended Solids. However, whilst Pollution Mitigation Index data is not provided in CIRIA C753 for gullies/catch pit manholes, it is anticipated that sumps at the base of the gullies and catch pits will provide a positive improvement that would mitigate the residual impact for the Total Suspended Solids.

Table 5: Assessment of Suitability of SuDS at the site as the drainage hierarchy

SUDS Group	Technique	Image	Description	Advantages	Disadvantages	Suitable for Use at Site
Retention	Balancing Pond		Provides both storm water attenuation and treatment. Run-off from each rain event is detained and treated in the pool. The retention time promotes pollutant removal through sedimentation.	Good removal of pollutants, can be used where groundwater is vulnerable, good community acceptability, high ecological, and amenity benefits.	No reduction in run-off volume, land take may limit use in high density sites.	✗ Not feasible for proposed development
	Sub-surface Storage		Oversized pipes, tank systems and modular geocellular systems that can be used to create a below ground storage structure.	Modular and flexible, dual usage (infiltration/storage, high void ratios), can be installed beneath trafficked and soft landscaped areas.	No water quality treatment.	✓ Sub-surface storage is feasible and recommended.
Wetland	Shallow wetland		Wetlands provide storm water attenuation and treatment. They comprise shallow ponds and marshy areas, covered in aquatic vegetation. Wetlands detain flows for an extended period to allow sediments to settle and to remove contaminants. They can provide significant ecological benefits.	Good pollutant removal and if lined can be used where groundwater is vulnerable. Good community acceptability, ecological and amenity benefits.	Land take is high, requires base flow, little reduction in run-off volume, not suitable for steep sites.	✗ Not feasible for proposed development
	Extended detention wetland					
	Pond wetland					
	Pocket wetland					
	Submerged gravel wetland					
	Wetland channel					
Infiltration	Infiltration trench		Surface water run-off can be discharged directly to ground for infiltration by soakaways, basins, or trenches. A prerequisite is that both groundwater and ground conditions are appropriate to receive the quality and quantity of water generated.	Reduces the volume of run-off, effective at pollutant removal, contributes to groundwater recharge, simple and cost-effective, easy performance observation.	Requires appropriate pre-treatment, basins require a large flat area, offset from foundations.	✗ Subsoils not conducive to infiltration.
	Infiltration basin					
	Soakaway					

SUDS Group	Technique	Image	Description	Advantages	Disadvantages	Suitable for Use at Site
	Porous paving		Block or porous paving allows run-off to infiltrate through to subbase layer. Water can then be infiltrated into ground or conveyed into storage or drainage systems.	Reduces the volume of run-off and if designed for infiltration contributes towards groundwater recharge. Easy to install and retrofit. Simple to manage. If lined can be used where groundwater is sensitive.	Not suitable for heavily trafficked areas or adoptable roads. Requires regular sweeping to prevent clogging with dirt.	✗ Not considered as part of previous approved scheme.
	Permeable paving					
Filtration	Surface sand filter		Structures designed to treat surface water run-off through filtration using a sand bed filter medium. The filters can be designed with or without infiltration. Temporary storage of run-off is achieved through ponding above the filter layer. They are used where particularly high pollutant removal is required.	Flexibility of design, efficient in removing pollutants, suitable for retrofits and in tightly constrained urban locations.	Not for high sediment content, detention times can support algae growth, minimum hydraulic head of 1.2m required, possible odour problems, high capital and maintenance cost.	✗ Not feasible for proposed development
	Sub-surface sand filter					
	Perimeter sand filter					
	Bioretention/filter swale		Vegetated strips of land designed to accept run-off as overland sheet flow between a hard-surfaced area and a receiving system.	Landscaping features, effective in removing pollutants, flexible layout to fit into landscape, suited for highly impervious areas, good retrofit, capability, effective pre-treatment option.	Requires landscaping and management, large land required, not suitable for steep sites; no significant attenuation or reduction of flows.	✗ Not feasible for proposed development
	Filter trench/drain		Shallow excavations filled with rubble or stone that create temporary subsurface storage for filtration of storm water run-off.	Hydraulic benefits achieved with filter trenches, trenches can be incorporated into site landscaping and fit	High clogging potential without effective pre-treatment, limited to small catchments,	✓ Alongside proposed car park to west subject to cross falls.

SUDS Group	Technique	Image	Description	Advantages	Disadvantages	Suitable for Use at Site
			Receive lateral inflow from an adjacent impermeable surface.	well beside roads and car parks.	high cost of replacing filter material.	
Detention	Detention basin		Surface storage basins that provide flow control through attenuation. Normally dry and in certain situations the land may also function as a recreational facility	Cater for a wide range of rainfall events, can be used where groundwater is vulnerable, potential for dual land use, easy to maintain.	Land take, little reduction in run-off volume, detention depths constrained by levels.	✗ Not feasible for proposed development
	Enhanced dry swale		Swales are linear vegetated drainage features in which surface water can be stored or conveyed. They can be designed to allow infiltration, where appropriate.	Incorporate into landscaping, good removal of pollutants, reduces run-off rates and volumes, low cost.	Not suitable for steep areas, significant land take, not suitable in areas with roadside parking.	✗ Not feasible for proposed development
	Enhanced wet swale					
Conveyance	Conveyance swales		Formal linear drainage features in which surface water can be stored or conveyed. They can be incorporated with water features such as ponds or waterfalls where appropriate.	Negate the need for underground pipework. Can provide some attenuation. Possible reduction in run-off volume via plant uptake and infiltration.	Potential trip/wheel hazard, disable access issues.	✗ Not feasible for proposed development
	Rills					
Source control	Green/brown roof		Multi-layered system that covers the roof of a building with vegetation cover/landscaping over a drainage layer. Designed to intercept and retain precipitation, reducing the volume of run-off and attenuating peak flows.	Mimics greenfield state of building footprint for high density developments, good removal of pollutants, ecological benefits, insulates buildings, sound absorption.	Additional weight, not appropriate for steep roofs, maintenance of roof vegetation.	✗ Not feasible for proposed development

5.4.1 Maintenance of SuDS

The on-site drainage will be managed by the site management company who will be responsible to maintain any on-site services including drainage. The off-site private drainage is managed by a management company managing the business park.

Table 6: Management and Maintenance Strategy

Drainage Feature	Regular Maintenance	Occasional/Remedial Maintenance	Monitoring
Drainage channels/Gullies	- Inspections will include gratings; covers including their locking bolts; sumps and sump buckets; exposed concrete surround and adjacent surfacing. - Check for accumulation of debris and silt and cleaned as necessary - Gratings, frames and all associated locking parts to be checked for damage. - Exposed concrete and adjacent surfacing to be checked for cracking and general damage. - Check condition of inlet and outlet pipes, flow controls, baffles and isolation structures	- Channel/Slot cleaning will be by flushing with water or high-pressure jetting (no boiling water or cleaning agent will be used). All silt buckets and sumps will be cleaned out replaced back into the units ensuring they are correctly fitted. - All channel surfaces and joints will be checked and repaired as necessary. - Repair/rehabilitation of inlets, outlet, as required.	Inspect every 4 months or after large storm.
Manholes/Inspection Chambers	- Check for accumulation of debris and silt and clean as necessary. - Covers and frames to be checked for damage. - Exposed concrete and adjacent surfacing to be checked for cracking and general damage. - Check condition of inlet and outlet pipes, flap valves, baffles etc.	- Clean as necessary. - All manhole and inspection chamber covers and frames to be replaced as necessary. - Repair exposed concrete and surfacing as necessary - Repair/rehabilitation of inlets, outlet, overflows and vents, as required.	Inspect every 6 months or after large storm.
Attenuation Tank	- Check for accumulation of debris and silt and clean as necessary. - Check condition of inlet and outlet pipes and ventilation structures	- Clean as necessary. - Repair/rehabilitation of inlets and outlet, as required.	Inspect every 6 months or after large storm.

5.5 Sewer Flooding

The site will have new separate surface and foul water networks up until the final connection into the existing public combined sewer. A non-return/backflow valve shall be placed at the downstream end of the foul network to prevent surcharge of the foul network. Surface water discharge from the site will also be restricted therefore significantly improving the current situation.

Therefore, the risk of sewer flooding to the site post development work would remain unchanged.

5.6 Groundwater Flooding

The proposed development is likely to be constructed using PAD foundations and unlikely to impact the groundwater below the site.

Therefore, the risk from groundwater flooding will be remain as low.

5.7 Artificial Sources of Flooding

The proposed development work will not have an impact on artificial sources of flood risk.

5.8 Summary of Flood Risk from the Proposed Development

The flood risk to and from the proposed development has been assessed to remain low from all sources.

The flood risk to the development is summarised in Table 7.

Table 7: Summary of flood risk to the development

Type of Flooding	Source of Flooding	Flood Risk	Proposed Mitigation
Fluvial and Tidal	Whittle Hill Brook & Whittle Brook	Low	Not required
Surface Water	Runoff from the site and surrounding land	Low	Proposed restriction to discharge rates which has a significant reduction on runoff rates and volumes from the site.
Sewers	Surrounding public combined drainage systems	Low	None
Ground Water	Underlying geology and groundwater levels	Low	None.
Artificial Sources	none	Not applicable	

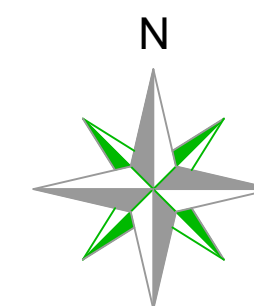
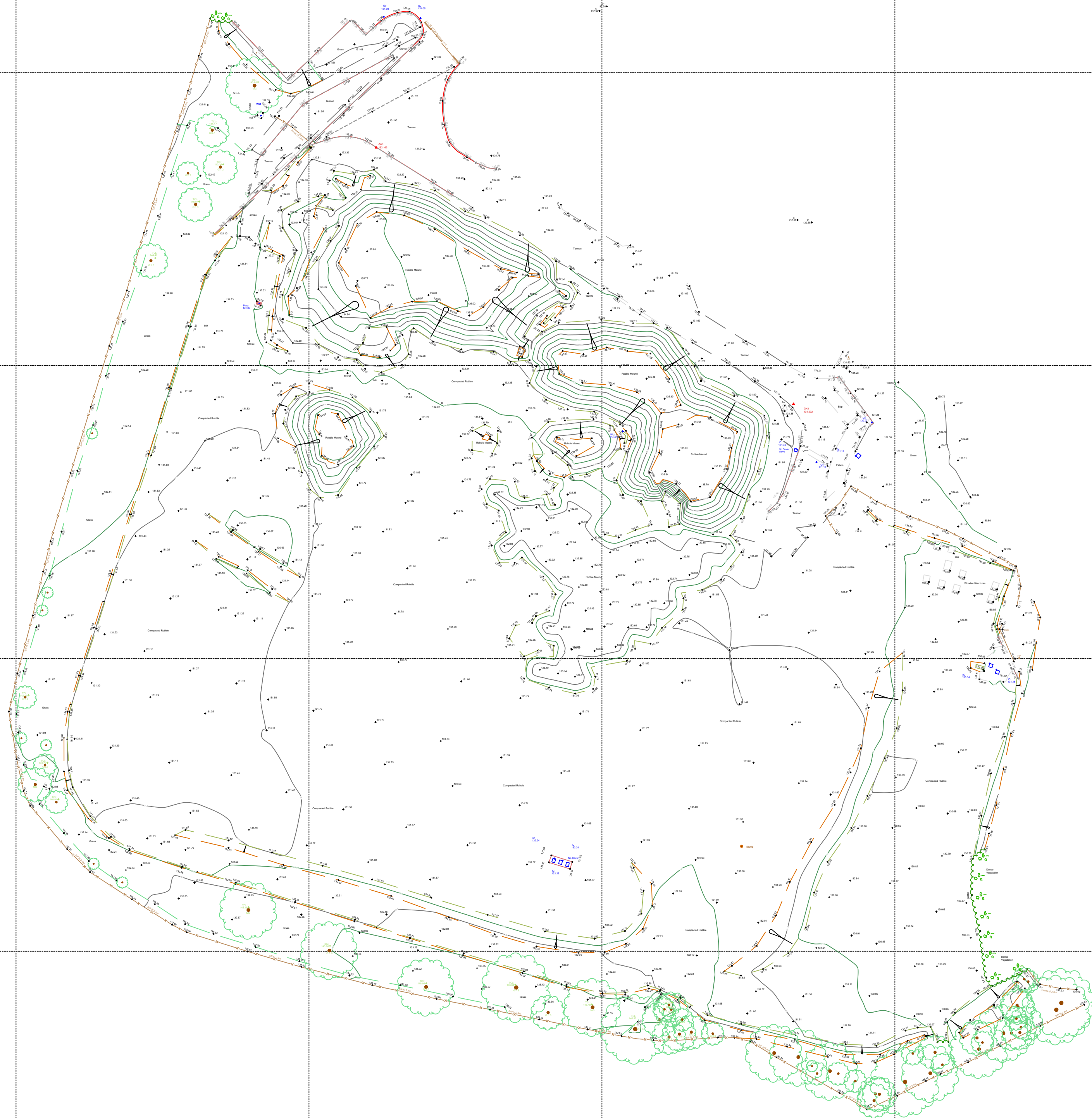
6. Conclusion

The existing flood risk to the development area from all sources has been assessed from a review of all available data. Future climate change has also been considered. Using the proposed development plan, the extent of the flood risk has been determined for the site as well as the effect that the development might have on flood risk elsewhere.

The assessment can be summarised as follows:

- The site is located in Flood Zone 1, low risk.
- The site is at low risk of flooding from all sources.
- The proposed development is classified as 'Less Vulnerable' and suitable for this location.
- The proposed development work would not increase the risk of flooding from any sources.
- The proposed development is within an area identified within Strategic FRAs for the City and surrounding areas.
- A drainage strategy is proposed in consideration with the local and national standard and would not increase the flood risk.
- The site is a Brownfield site with existing drainage in place and no formal restrictions on discharge rates. The existing site is 80% impermeable. The proposal is to limit the discharge from the redeveloped site to over 50% reduction of the existing site 30yr return period storm for all return periods, including climate change allowance.
- The proposed drainage scheme seeks to vary the previous scheme approved under Planning Ref. 24/00453/VRCON and listed in the associated condition 6.
- A geotechnical assessment by Applied Geology has shown that due to the thickness of Made Ground and the cohesive nature of it the subsoils are not conducive to infiltration.
- In conclusion, the proposed development work will not increase the risk of flooding to the site or surrounding areas in accordance with the provisions of relevant national and local planning policies.

Appendix A Topographical & Utility Survey Plans



SURVEY STATIONS			
Name	Easting	Northing	Height
GH1	384126.703	408363.368	130.841
GH2	384061.458	408287.210	132.163
GH3	384132.707	408243.427	131.202

OS Note:

This survey has been originated to the Ordnance Survey (O.S.) National Grid OSG36(15) via Global Navigation Satellite Systems (GNSS) and the O.S. Active Network (OS Net).

A true OSG36 coordinate has been established near to the site of the station using the OSTN15GB & OSGM15GB transformation models.

The survey has been correlated to this point and a further one or more OSG36 (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 Ordnance Survey Station.

[illegible]

Rev	Date	Description	Drawn	Q. Ref.
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- Topographical Surveys
- Site Engineering
- Utility / CCTV Surveys
- Measured Building Surveys
- 3D Laser Scanning
- Revit & BIM Models

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CLIENT	Chancerygate
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PROJECT

Birch Business Park
Whittle Lane
Heywood, OL10 2SX

TITLE	Topographical Survey
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SCALE A1@ 1:500	DATE SURVEYED 12/08/2025
DRAWN JT	QUALITY REF GH25961

<i>Level datum</i>	See note
<i>Grid orientation</i>	See note
<i>Job number</i>	55340

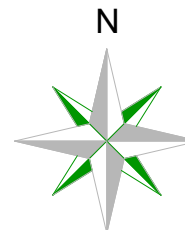
Drawing No.	Rev.
55340_T	0

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:**
- In all cases please call the BT One before you dig, verify to mark their own point before any site works commence.
 - Always consult utility plans.
 - Orange information provided has been determined without need entry into the manholes. Whilst every effort has been made to ensure accuracy, the information is not a guarantee of accuracy. It is recommended that the information should be checked in the field.
 - All survey points are assumed to be straight line connections between chambers unless proven otherwise by the use of a surveying instrument.
 - The drainage system is shown as a series of lines. It is not intended to show the exact location of the drainage system. It is intended to show the general location of the drainage system.
 - The drainage system is shown as a series of lines. It is not intended to show the exact location of the drainage system. It is intended to show the general location of the drainage system.
 - We have completed the survey to the best of our knowledge and belief. We have not been able to verify the accuracy of the survey.
 - GPS and PowerBooks cannot collect data due to large areas of existing ground and existing sites.

UTILITY LINETYPES		Utility Line Type	Utility Line Type
Water Mains	100mm	Water Mains	100mm
Water Mains	150mm	Water Mains	150mm
Water Mains	200mm	Water Mains	200mm
Water Mains	250mm	Water Mains	250mm
Water Mains	300mm	Water Mains	300mm
Water Mains	350mm	Water Mains	350mm
Water Mains	400mm	Water Mains	400mm
Water Mains	450mm	Water Mains	450mm
Water Mains	500mm	Water Mains	500mm
Water Mains	550mm	Water Mains	550mm
Water Mains	600mm	Water Mains	600mm
Water Mains	650mm	Water Mains	650mm
Water Mains	700mm	Water Mains	700mm
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Water Mains	800mm	Water Mains	800mm
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Water Mains	9900mm	Water Mains	9900mm
Water Mains	9950mm	Water Mains	9950mm
Water Mains	10000mm	Water Mains	10000mm

PAS 128: 2022 LEVEL 8 SURVEY		
QUALITY LEVEL	DEFINITION OF THE QUALITY LEVEL	LOCATION ACCURACY
Level 8	Level 8: The highest level of accuracy for a survey. It is defined as a survey that is accurate to within 10mm of the true value.	Unrestricted
Level 7	Level 7: The second highest level of accuracy for a survey. It is defined as a survey that is accurate to within 20mm of the true value.	Unrestricted
Level 6	Level 6: The third highest level of accuracy for a survey. It is defined as a survey that is accurate to within 30mm of the true value.	Unrestricted
Level 5	Level 5: The fourth highest level of accuracy for a survey. It is defined as a survey that is accurate to within 40mm of the true value.	Unrestricted
Level 4	Level 4: The fifth highest level of accuracy for a survey. It is defined as a survey that is accurate to within 50mm of the true value.	Unrestricted
Level 3	Level 3: The sixth highest level of accuracy for a survey. It is defined as a survey that is accurate to within 60mm of the true value.	Unrestricted
Level 2	Level 2: The seventh highest level of accuracy for a survey. It is defined as a survey that is accurate to within 70mm of the true value.	Unrestricted
Level 1	Level 1: The eighth highest level of accuracy for a survey. It is defined as a survey that is accurate to within 80mm of the true value.	Unrestricted

DISCLAIMER

Whilst every effort has been taken in the preparation of this drawing, the original data and/or information supplied may have been altered since the survey/drawing was produced. The user shall make further enquiries and investigations to verify the accuracy of the information and the position of the apparatus. The exact position of the apparatus should be verified by the use of suitable detection methods and not rely on the information provided in this drawing. Further details on the location of apparatus should be recommended by the user. No representation is made by Greenhatch Group, its agents or servants as to the accuracy, completeness, and sufficiency of this drawing and the position of the apparatus.

All apparatus shall be treated as live unless stated 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	Cd	Rev
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- Topographical Surveys
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- Utility / CCTV Surveys
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- 3D Laser Scanning
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CLIENT

Chancerygate

PROJECT

Birch Business Park
Whittle Lane
Heywood, OL10 2SX

TITLE

Utility
Survey

SCALE A1@ 1: 500	DATE 27.08.25
DRAWN JWS, JCH	QUALITY REF GH26134

Level datum

Grid orientation

Job number 55340

Drawing No. 55340_T_UG Rev. 0

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:

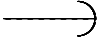
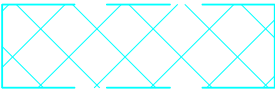
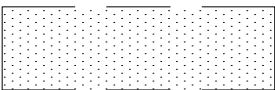
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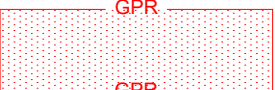
UTILITY LINETYPES

Air Line	
British Telecom	
British Telecom Overhead	
CCTV / Cable Television	
Communication Cable	
Drainage - Combined Water	
Drainage - Foul Water	
Drainage - Storm Water	
Drainage - Unknown Water	
Drainage - Trade Effluent Water	
Drainage - Combined Water - Assumed/TFR	
Drainage - Foul Water - Assumed/TFR	
Drainage - Storm Water - Assumed/TFR	
Drainage - Unknown Water - Assumed/TFR	
Drainage - Trade Effluent Water - Assumed/TFR	
Drainage - Approximate Pipe Size/Extents	
Earth Cable	
Empty Duct	
Electric & Comms	

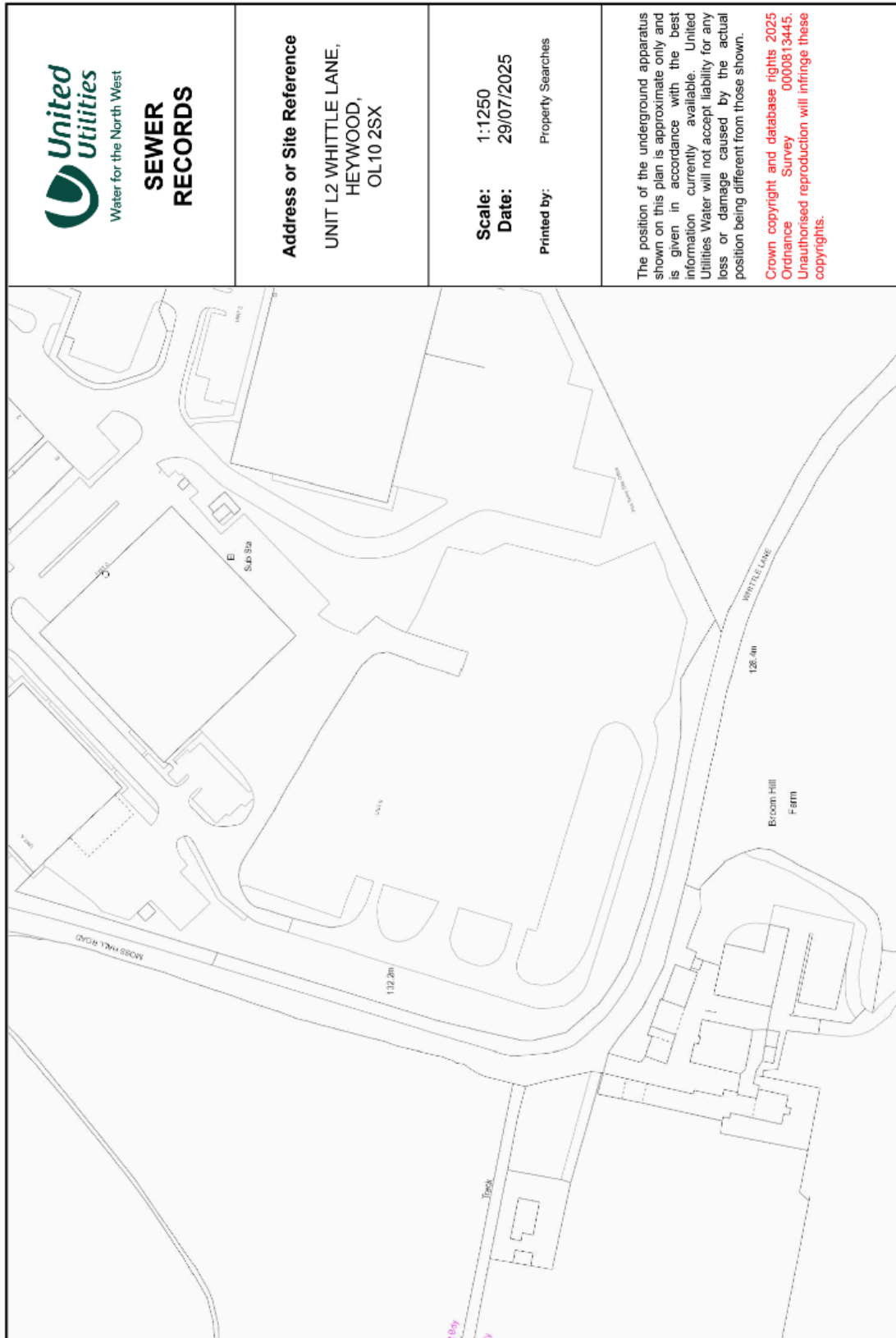
Electric Low Voltage	
Electric High Voltage	
Electric - Unknown Voltage	
Electric Overhead	
Fibre Optic	
Fuel Line	
Gas Line	
Gauge Line	
GPR Line	
Heating Pipes	
Offset Fills	
Oil Pipe	
Rising Main	
Sensor Cable	
Telecom	
Traffic Light Signals	
Trench Scar	
Unknown	
Vapour Recovery	
Vent Line	
Virgin Media	
Water	

UTILITY SURVEY INFORMATION

Contracted Survey Area	
Depth to Top of Service (m)	0.40d
End of Trace / Record	 EOT
Head of Run	HoR
Weak Signal	WS
Taken From Records	TFR
Off Survey Area	OSA
Back Drop	BD
Silt Level	SL
Flow Level	FL
Above Ground	A/G
Unable to Locate	UTL
Unable to Survey	UTS
Unable to Raise (cover)	UTR
Unable to Trace	UTT
Unable to Survey	
Unable to GPR in this area	
Approximate Chamber Extents	

Assumed Route	AR
Assumed Connection	ACP
Sound Connection	S/C
Sonde Stopped	S/S
No Visible Access	NVA
No Visible Exit	NVE
No Visible Pipes	NVP
No Visible Services	NVS
No Depth Indicated	NDI
Base Level	BL
High Level	HL
Top of Pipe / Top of Valve	ToP / ToV
Landing Level	LL
Rubble Level	RL
No Signal	N/S
Heavily Silted	H/S
Approximate Location (ApL)	
GPR Anomaly	
Multiple Services Route	

Appendix B United Utility Public Sewer Map



Appendix C Proposed Development Plan

General Notes:

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- Site Boundary - 5.39 Acres (2.18Ha)
- Below Ground Electricity Line
- Above Ground Electricity Line
- Concrete Service Yard
- Tarmac Parking Spaces
- Tarmac Road
- Feature Paving
- Building Perimeter Paving
- Gravel
- Grass
- Grasscrete

P01 Issued for planning JB 21.01.26

Rev. Revision Details Drawn Date Check'd

Project No. 25026-HFR-UB-XX-DR-A-9002

Subsidiary So WORK IN PROGRESS

Status

Client: Chancerygate

Project: Birch Business Park

Sheet Name: Proposed Site Plan

Drawing No. 25026-HFR-UB-XX-DR-A-9002 Rev. P01

Drawn by JB Scale As indicated @ A0

Created

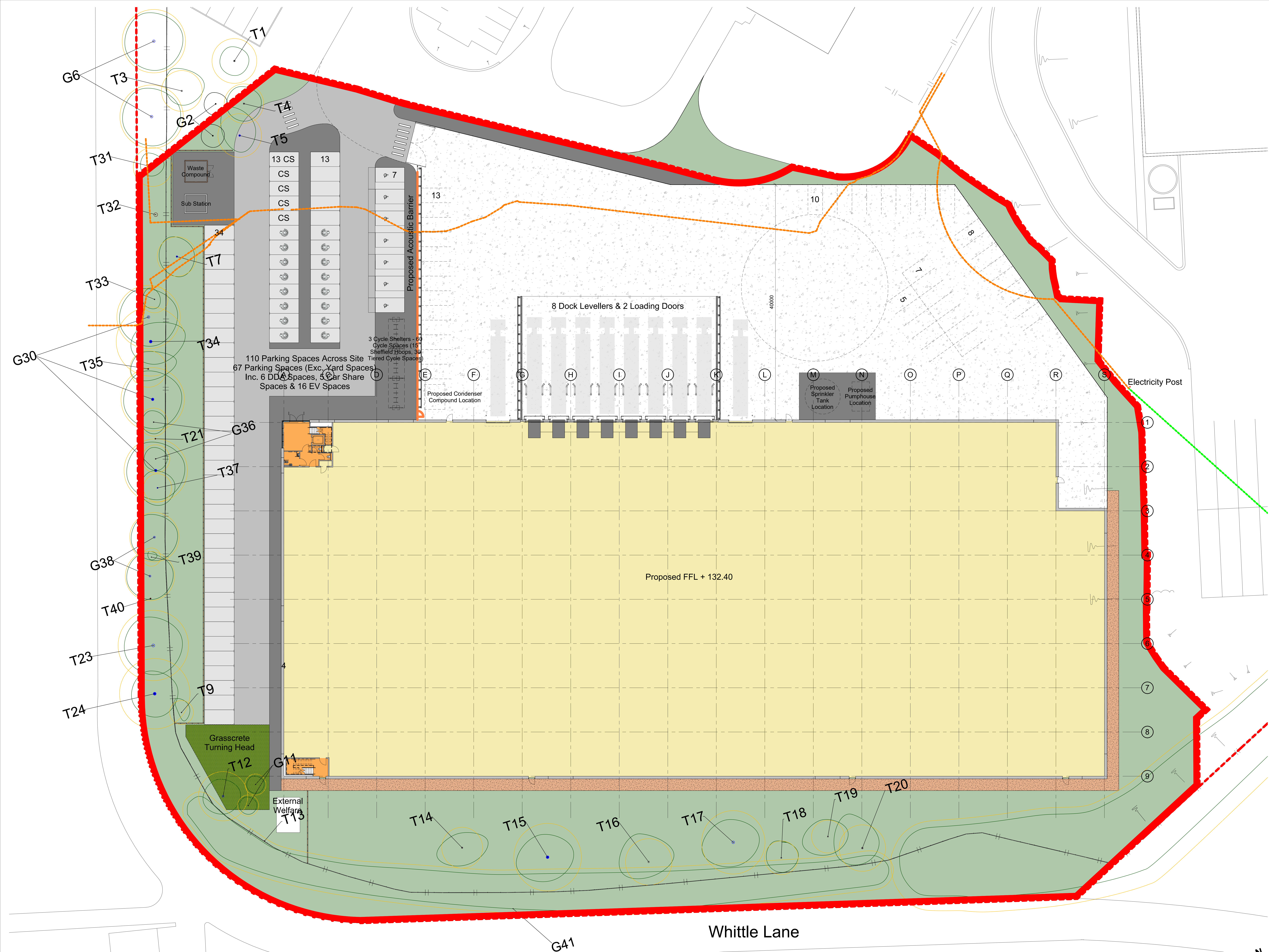
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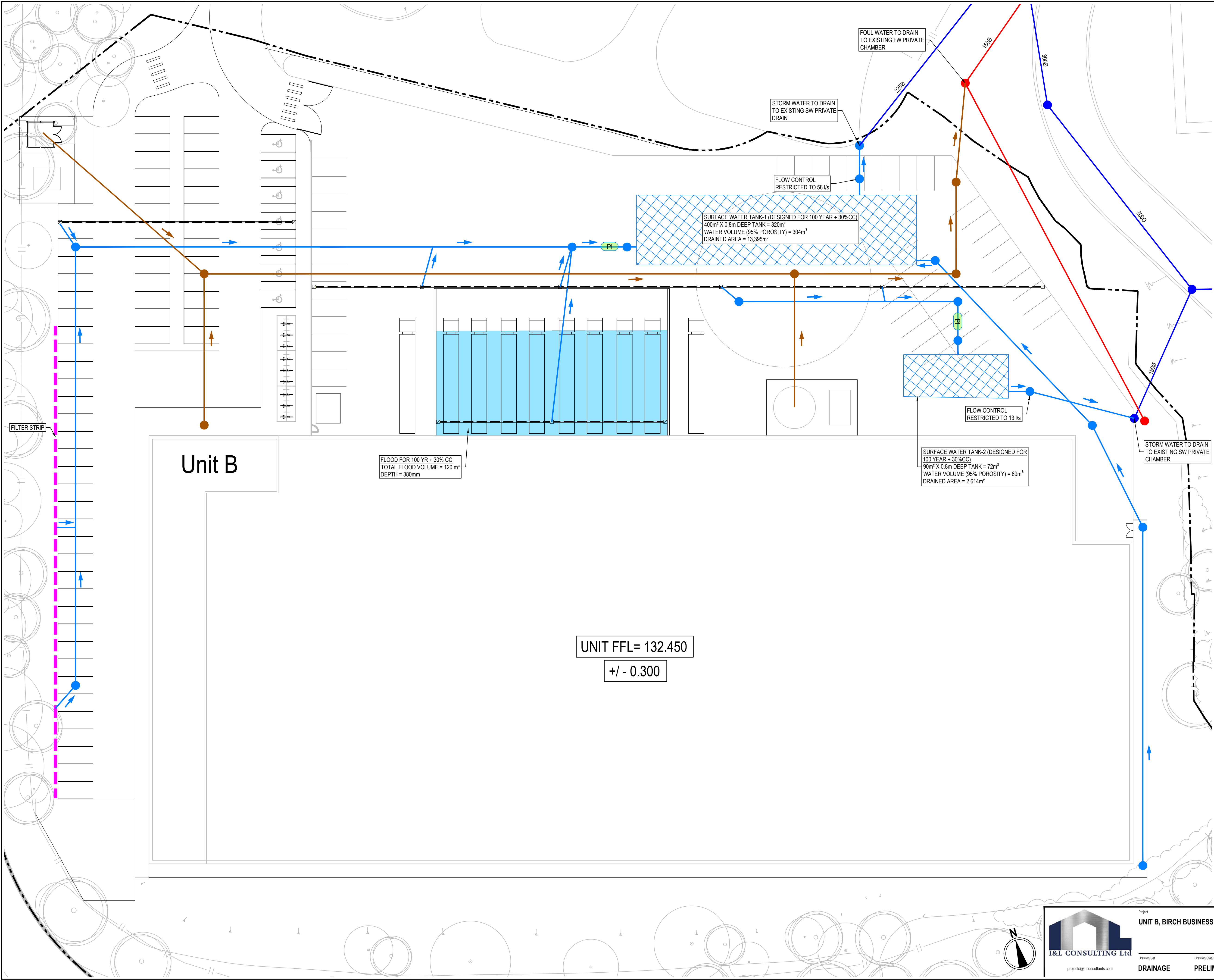
Appendix D Proposed Drainage Strategy Layout

STRATEGY

1. THIS DRAWING SHOULD ONLY USED TO SUPPORT A PLANNING APPLICATION AND MAY FORM PART OF A FLOOD RISK ASSESSMENT. IT FORMS AN INTENDED STRATEGY THAT WILL BE DEVELOPED IN MORE DETAIL.
2. DO NOT USE THIS DRAWING FOR DETAILED COST ESTIMATES OR TENDER PURPOSES.
- PRE-DEVELOPMENT:
3. THE EXISTING SITE IS PRE-DEVELOPED AND DISCHARGES INTO AN ORDINARY WATERCOURSE VIA 225Ø & 150Ø PIPES.
- PROPOSAL:
4. THE NEW DEVELOPMENT SHALL BE RESTRICTED TO 71 l/s. THIS IS BASED ON A 58% REDUCTION OF THE EXISTING 30Yr RETURN PERIOD STORM FOR ALL RETURN PERIODS.
5. THE PROPOSED SITE SHALL DISCHARGE INTO EXISTING WATERCOURSE VIA AN EXISTING PRIVATE NETWORK.
6. TOTAL ATTENUATION FOR 100Yr+30% CLIMATE CHANGE STORM EVENT STORED BELOW GROUND = 373m³ AND ABOVE SURFACE = 120m³.
- HYDRAULIC DESIGN:
7. THE SURFACE WATER NETWORK, FLOW CONTROL AND ATTENUATION HAS BEEN DESIGNED USING DRAINAGE SOFTWARE WITH FSR RAINFALL DATA.
- FINAL DRAINAGE CONNECTIONS:
8. DISCHARGE POINTS SHOWN MAY NEED TO BE FURTHER INVESTIGATED IN TERMS OF LOCATING AND INVERT LEVELS.
9. APPROVAL SHALL BE OBTAINED FOR INTENDED DISCHARGE INTO THE PUBLIC SEWER/MAJOR WATER COURSE/ORDINARY WATERCOURSE.
- MAINTENANCE:
10. THE NETWORK AND ALL ANCILLARY COMPONENTS SHALL RECEIVE REGULAR MAINTENANCE AS OUTLINED IN SEPARATE SCHEDULE.
- AREAS:
- | | |
|---------------------------|---------|
| SITE AREA | 2.47 ha |
| EXISTING IMPERMEABLE AREA | 1.16 ha |
| PROPOSED IMPERMEABLE AREA | 1.60 ha |

LEGEND

- SITE BOUNDARY
- EXISTING PRIVATE FW
- EXISTING PRIVATE SW
- NEW STORM WATER RUN
- NEW FOUL WATER RUN
- PI PETROL INTERCEPTOR
SERVICE YARD AND OTHER VEHICULAR
ACCESSED AREAS TO PASS THROUGH
PETROL INTERCEPTOR BEFORE
DRAINING TO TANK.



Project		Drawing			
UNIT B, BIRCH BUSINESS PARK		DRAINAGE PLANNING STRATEGY			
Drawing Set	Drawing Status	Scale	Project Number	Drawing Number	Revision
DRAINAGE	PRELIMINARY	1:250 @ A1	25-021-I&L	D00	P1

Appendix E Hydraulic Calculations

**Nodes**

Name	Area (ha)
tank 1	1.340

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
Rainfall Events	Singular	Skip Steady State	✓
FSR Region	England and Wales	Drain Down Time (mins)	1440
M5-60 (mm)	19.000	Additional Storage (m³/ha)	0.0
Ratio-R	0.308	Starting Level (m)	
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320
30	120	240	480	720	1440	2880	5760

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

Node tank 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	130.000	Product Number	CTL-SHE-0295-5800-2400-5800
Design Depth (m)	2.400	Min Outlet Diameter (m)	0.375
Design Flow (l/s)	58.0	Min Node Diameter (mm)	3000

Node tank 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	130.100
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	45

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	400.0	0.0	0.800	400.0	0.0	0.801	0.0	0.0

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	95.230	26.947	1 year 180 minute winter	15.479	6.128
1 year 15 minute winter	66.828	26.947	1 year 240 minute summer	19.370	5.119
1 year 30 minute summer	64.434	18.233	1 year 240 minute winter	12.869	5.119
1 year 30 minute winter	45.217	18.233	1 year 360 minute summer	15.266	3.928
1 year 60 minute summer	45.726	12.084	1 year 360 minute winter	9.923	3.928
1 year 60 minute winter	30.379	12.084	1 year 480 minute summer	12.320	3.256
1 year 120 minute summer	29.850	7.888	1 year 480 minute winter	8.185	3.256
1 year 120 minute winter	19.832	7.888	1 year 600 minute summer	10.291	2.815
1 year 180 minute summer	23.812	6.128	1 year 600 minute winter	7.032	2.815

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 720 minute summer	9.327	2.500	30 year 2160 minute winter	5.820	2.334
1 year 720 minute winter	6.269	2.500	30 year 2880 minute summer	7.047	1.889
1 year 960 minute summer	7.875	2.074	30 year 2880 minute winter	4.736	1.889
1 year 960 minute winter	5.217	2.074	30 year 4320 minute summer	5.353	1.399
1 year 1440 minute summer	5.943	1.593	30 year 4320 minute winter	3.525	1.399
1 year 1440 minute winter	3.994	1.593	30 year 5760 minute summer	4.422	1.132
1 year 2160 minute summer	4.424	1.223	30 year 5760 minute winter	2.862	1.132
1 year 2160 minute winter	3.048	1.223	100 year +30% CC 15 minute summer	391.086	110.664
1 year 2880 minute summer	3.785	1.014	100 year +30% CC 15 minute winter	274.446	110.664
1 year 2880 minute winter	2.544	1.014	100 year +30% CC 30 minute summer	268.700	76.033
1 year 4320 minute summer	2.986	0.781	100 year +30% CC 30 minute winter	188.561	76.033
1 year 4320 minute winter	1.967	0.781	100 year +30% CC 60 minute summer	188.962	49.937
1 year 5760 minute summer	2.520	0.645	100 year +30% CC 60 minute winter	125.542	49.937
1 year 5760 minute winter	1.631	0.645	100 year +30% CC 120 minute summer	119.657	31.622
30 year 15 minute summer	232.978	65.925	100 year +30% CC 120 minute winter	79.497	31.622
30 year 15 minute winter	163.494	65.925	100 year +30% CC 180 minute summer	92.449	23.790
30 year 30 minute summer	158.380	44.816	100 year +30% CC 180 minute winter	60.094	23.790
30 year 30 minute winter	111.144	44.816	100 year +30% CC 240 minute summer	72.952	19.279
30 year 60 minute summer	110.635	29.238	100 year +30% CC 240 minute winter	48.468	19.279
30 year 60 minute winter	73.503	29.238	100 year +30% CC 360 minute summer	55.779	14.354
30 year 120 minute summer	70.036	18.508	100 year +30% CC 360 minute winter	36.258	14.354
30 year 120 minute winter	46.530	18.508	100 year +30% CC 480 minute summer	43.973	11.621
30 year 180 minute summer	54.352	13.987	100 year +30% CC 480 minute winter	29.215	11.621
30 year 180 minute winter	35.330	13.987	100 year +30% CC 600 minute summer	36.028	9.854
30 year 240 minute summer	43.139	11.400	100 year +30% CC 600 minute winter	24.616	9.854
30 year 240 minute winter	28.660	11.400	100 year +30% CC 720 minute summer	32.114	8.607
30 year 360 minute summer	33.217	8.548	100 year +30% CC 720 minute winter	21.583	8.607
30 year 360 minute winter	21.592	8.548	100 year +30% CC 960 minute summer	26.370	6.944
30 year 480 minute summer	26.330	6.958	100 year +30% CC 960 minute winter	17.468	6.944
30 year 480 minute winter	17.493	6.958	100 year +30% CC 1440 minute summer	19.098	5.119
30 year 600 minute summer	21.670	5.927	100 year +30% CC 1440 minute winter	12.835	5.119
30 year 600 minute winter	14.806	5.927	100 year +30% CC 2160 minute summer	13.615	3.763
30 year 720 minute summer	19.390	5.197	100 year +30% CC 2160 minute winter	9.381	3.763
30 year 720 minute winter	13.032	5.197	100 year +30% CC 2880 minute summer	11.268	3.020
30 year 960 minute summer	16.025	4.220	100 year +30% CC 2880 minute winter	7.573	3.020
30 year 960 minute winter	10.615	4.220	100 year +30% CC 4320 minute summer	8.452	2.210
30 year 1440 minute summer	11.720	3.141	100 year +30% CC 4320 minute winter	5.566	2.210
30 year 1440 minute winter	7.877	3.141	100 year +30% CC 5760 minute summer	6.926	1.773
30 year 2160 minute summer	8.446	2.334	100 year +30% CC 5760 minute winter	4.483	1.773

**Results for 1 year Critical Storm Duration. Lowest mass balance: 99.18%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
60 minute winter	tank 1	43	130.262	0.162	92.7	61.5876	0.0000	OK

Link Event (Outflow)	US Node	Link	Outflow (l/s)
60 minute winter	tank 1	Hydro-Brake®	44.0

**Results for 30 year Critical Storm Duration. Lowest mass balance: 99.15%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
60 minute winter	tank 1	48	130.615	0.515	224.2	195.9834	0.0000	OK

Link Event (Outflow)	US Node	Link	Outflow (l/s)
60 minute winter	tank 1	Hydro-Brake®	57.8

**Results for 100 year +30% CC Critical Storm Duration. Lowest mass balance: 99.23%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
120 minute winter	tank 1	72	132.272	2.172	246.2	304.3800	120.9502	FLOOD

Link Event (Outflow)	US Node	Link	Outflow (l/s)
120 minute winter	tank 1	Hydro-Brake®	58.0

Nodes

Name	Area (ha)
tank 2	0.261

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
Rainfall Events	Singular	Skip Steady State	✓
FSR Region	England and Wales	Drain Down Time (mins)	1440
M5-60 (mm)	19.000	Additional Storage (m³/ha)	0.0
Ratio-R	0.308	Starting Level (m)	
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320
30	120	240	480	720	1440	2880	5760

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

Node tank 2 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	130.400	Product Number	CTL-SHE-0161-1300-1200-1300
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	13.0	Min Node Diameter (mm)	1500

Node tank 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	130.657
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	52

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	90.0	0.0	0.800	90.0	0.0	0.801	0.0	0.0

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	95.230	26.947	1 year 180 minute winter	15.479	6.128
1 year 15 minute winter	66.828	26.947	1 year 240 minute summer	19.370	5.119
1 year 30 minute summer	64.434	18.233	1 year 240 minute winter	12.869	5.119
1 year 30 minute winter	45.217	18.233	1 year 360 minute summer	15.266	3.928
1 year 60 minute summer	45.726	12.084	1 year 360 minute winter	9.923	3.928
1 year 60 minute winter	30.379	12.084	1 year 480 minute summer	12.320	3.256
1 year 120 minute summer	29.850	7.888	1 year 480 minute winter	8.185	3.256
1 year 120 minute winter	19.832	7.888	1 year 600 minute summer	10.291	2.815
1 year 180 minute summer	23.812	6.128	1 year 600 minute winter	7.032	2.815

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 720 minute summer	9.327	2.500	30 year 2160 minute winter	5.820	2.334
1 year 720 minute winter	6.269	2.500	30 year 2880 minute summer	7.047	1.889
1 year 960 minute summer	7.875	2.074	30 year 2880 minute winter	4.736	1.889
1 year 960 minute winter	5.217	2.074	30 year 4320 minute summer	5.353	1.399
1 year 1440 minute summer	5.943	1.593	30 year 4320 minute winter	3.525	1.399
1 year 1440 minute winter	3.994	1.593	30 year 5760 minute summer	4.422	1.132
1 year 2160 minute summer	4.424	1.223	30 year 5760 minute winter	2.862	1.132
1 year 2160 minute winter	3.048	1.223	100 year +30% CC 15 minute summer	391.086	110.664
1 year 2880 minute summer	3.785	1.014	100 year +30% CC 15 minute winter	274.446	110.664
1 year 2880 minute winter	2.544	1.014	100 year +30% CC 30 minute summer	268.700	76.033
1 year 4320 minute summer	2.986	0.781	100 year +30% CC 30 minute winter	188.561	76.033
1 year 4320 minute winter	1.967	0.781	100 year +30% CC 60 minute summer	188.962	49.937
1 year 5760 minute summer	2.520	0.645	100 year +30% CC 60 minute winter	125.542	49.937
1 year 5760 minute winter	1.631	0.645	100 year +30% CC 120 minute summer	119.657	31.622
30 year 15 minute summer	232.978	65.925	100 year +30% CC 120 minute winter	79.497	31.622
30 year 15 minute winter	163.494	65.925	100 year +30% CC 180 minute summer	92.449	23.790
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30 year 30 minute winter	111.144	44.816	100 year +30% CC 240 minute summer	72.952	19.279
30 year 60 minute summer	110.635	29.238	100 year +30% CC 240 minute winter	48.468	19.279
30 year 60 minute winter	73.503	29.238	100 year +30% CC 360 minute summer	55.779	14.354
30 year 120 minute summer	70.036	18.508	100 year +30% CC 360 minute winter	36.258	14.354
30 year 120 minute winter	46.530	18.508	100 year +30% CC 480 minute summer	43.973	11.621
30 year 180 minute summer	54.352	13.987	100 year +30% CC 480 minute winter	29.215	11.621
30 year 180 minute winter	35.330	13.987	100 year +30% CC 600 minute summer	36.028	9.854
30 year 240 minute summer	43.139	11.400	100 year +30% CC 600 minute winter	24.616	9.854
30 year 240 minute winter	28.660	11.400	100 year +30% CC 720 minute summer	32.114	8.607
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30 year 360 minute winter	21.592	8.548	100 year +30% CC 960 minute summer	26.370	6.944
30 year 480 minute summer	26.330	6.958	100 year +30% CC 960 minute winter	17.468	6.944
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30 year 600 minute winter	14.806	5.927	100 year +30% CC 2160 minute summer	13.615	3.763
30 year 720 minute summer	19.390	5.197	100 year +30% CC 2160 minute winter	9.381	3.763
30 year 720 minute winter	13.032	5.197	100 year +30% CC 2880 minute summer	11.268	3.020
30 year 960 minute summer	16.025	4.220	100 year +30% CC 2880 minute winter	7.573	3.020
30 year 960 minute winter	10.615	4.220	100 year +30% CC 4320 minute summer	8.452	2.210
30 year 1440 minute summer	11.720	3.141	100 year +30% CC 4320 minute winter	5.566	2.210
30 year 1440 minute winter	7.877	3.141	100 year +30% CC 5760 minute summer	6.926	1.773
30 year 2160 minute summer	8.446	2.334	100 year +30% CC 5760 minute winter	4.483	1.773

**Results for 1 year Critical Storm Duration. Lowest mass balance: 99.18%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
15 minute winter	tank 2	14	130.718	0.061	32.0	5.2902	0.0000	OK

Link Event (Outflow)	US Node	Link	Outflow (l/s)
15 minute winter	tank 2	Hydro-Brake®	12.9

**Results for 30 year Critical Storm Duration. Lowest mass balance: 99.02%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
60 minute winter	tank 2	47	130.983	0.326	43.8	27.9315	0.0000	OK

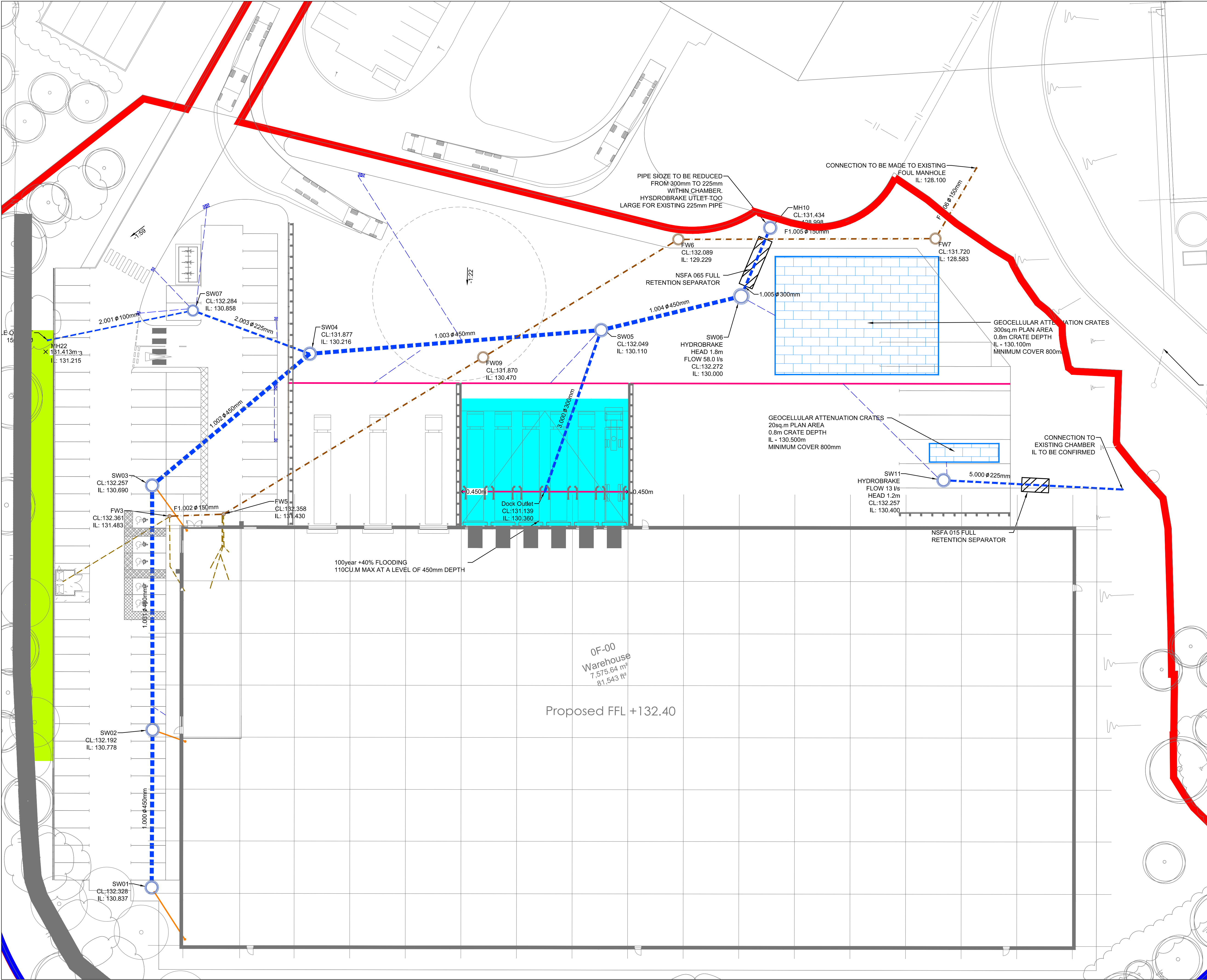
Link Event (Outflow)	US Node	Link	Outflow (l/s)
60 minute summer	tank 2	Hydro-Brake®	13.0

**Results for 100 year +30% CC Critical Storm Duration. Lowest mass balance: 99.11%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
60 minute winter	tank 2	58	131.447	0.790	74.7	67.5508	0.0000	OK

Link Event (Outflow)	US Node	Link	Outflow (l/s)
480 minute summer	tank 2	Hydro-Brake®	13.0

Appendix F Previous Approved Scheme



GENERAL NOTES

- 1. DRAWINGS ARE TO BE READ IN CONJUNCTION WITH ALL RELEVANT SPECIFICATIONS, ENGINEERS, ARCHITECTS & SERVICES DRAWINGS, INCLUDING APPROVED BUILDERS WORK DRAWINGS. CONTRACTOR TO NOTIFY ENGINEER OF DISCREPANCIES BETWEEN STRUCTURAL DRAWINGS AND SPECIFICATIONS OR OTHER DRAWINGS.
- 2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
- 3. DO NOT SCALE FROM THIS DRAWING, WORK TO DIMENSIONS OR CO-ORDINATES PROVIDED. ALL LEVELS ARE IN METRES AND ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS OTHERWISE NOTED. ANY AMBIGUITIES, OMISSIONS AND ERRORS ON DRAWINGS, SHALL BE BROUGHT TO THE ENGINEERS ATTENTION IMMEDIATELY.
- 4. INFORMATION CONTAINED ON THIS DRAWING IS TENDER DESIGN ONLY. FURTHER DETAILED DESIGN AND CO-ORDINATION WITH THE CONTRACTOR, DESIGN TEAM AND APPROPRIATE SUB-CONTRACTORS WILL BE REQUIRED TO FULLY DEVELOP AND DETAIL THE FINAL CONSTRUCTION DETAILS. CONTRACTOR TO USE THEIR EXPERIENCE AND JUDGEMENT TO MAKE SUFFICIENT ALLOWANCES FOR DETAILED DESIGN DEVELOPMENT.

DRAINAGE KEY

- PROPOSED FW SEWER
- PROPOSED FW MANHOLE
- PROPOSED LATERAL FW DRAIN
- PROPOSED LATERAL FW PPIC
- PROPOSED FW RISING MAIN
- PROPOSED SW SEWER
- PROPOSED SW MANHOLE
- PROPOSED LATERAL SW DRAIN
- PROPOSED LATERAL SW PPIC
- PROPOSED DRAINAGE CHANNEL
- PROPOSED GEOCELLULAR ATTENUATION
- PROPOSED SWALE

P5	12.05.22	AP	PB	LAYOUT UPDATE
P4	10.05.22	AP	PB	TENDER ISSUE
P3	11.04.22	AP	PB	ATTENUATION REVIEW
P2	03.03.22	AP	PB	BOUNDARY UPDATE
P1	21.02.22	AP	PB	TENDER ISSUE
No	DATE	DRAWN	REV'D ENG.	AMENDMENT

STATUS	PURPOSE OF ISSUE
D2	TENDER

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RIDGE

CLIENT
YEARGATE LIMITED

PROJECT
UNIT B
BIRCH BUSINESS PARK

DRAFTER
AP

ENGINEER
PB

TITLE
UNIT B
PROPOSED
DRAINAGE GA

PROJECT REFERENCE:

SCALE
1:500

SHEET
A1

DRAWING No
BUB-RDG-00-ZZ-DR-C-0501

REV
P5