SDS consulting
civil & structural engineers

SAPPHIRE CENTRE, FISHPONDS ROAD, WOKINGHAM

FRA & DRAINAGE STRATEGY

Apacor Ltd c/o LPC (Trull) Ltd

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1. INTRODUCTION

Introduction

1.1. SDS Consulting has been commissioned by the client to provide a Flood Risk Assessment and Drainage Strategy (FRADS) report to support a planning application for the proposed extension to the rear of the existing APACOR facility by connecting with an existing commercial building to the rear, with associated works. This report has been prepared in accordance with the requirements set out in the National Planning Policy Framework (NPPF), the associated Planning Policy Guidelines (PPG) and local policy requirements.

1.2. This FRADS is intended to support a planning application and as such the level of detail included is commensurate and subject to the nature of the proposals.

Objectives & Scope

1.3. The objective of this report is:

- Review all sources of flood risk
- Determine the pre and post development conditions for surface water runoff
- Detail a drainage strategy for the management and maintenance of the surface water generated from the proposed development

1.4. The scope of this drainage strategy is to discharge planning conditions

Limitations

1.5. The general limitations of this report are that:

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2. SITE CONTEXT

Development Proposals

2.1. The development proposals, in which this drainage strategy is written for, comprise ae proposed extension to the rear of the existing APACOR facility by connecting with an existing commercial building to the rear, with associated works. at Sapphire Centre, Fishponds Road, Wokingham.

2.2. Refer to Studio Tivoli drawings in **Appendix A** for the development proposals.

Site Location

2.3. The development is located at APACOR, Sapphire Centre, Fishponds Road, Wokingham, RG41 2QL. The site is a brownfield site with the new works area comprising of an existing commercial building and car parking area. The site is located as per **Figure 1 & 2** below.

Figure 1 : Site Location Plan

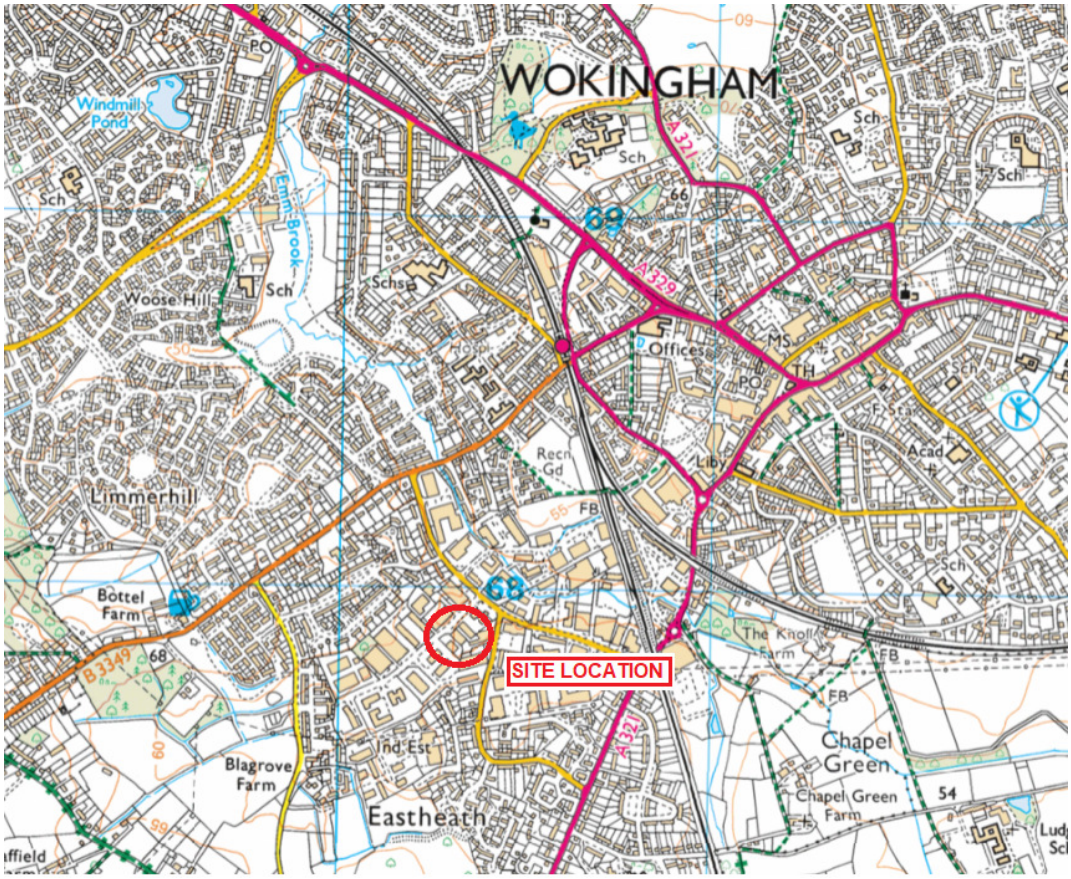


Figure 2: Approximate site boundary

Topography

2.4. Refer to **Appendix B** for a topographical survey of the existing site area prior to the development approved under planning application reference 212350. A topographical survey for the extended site area and external areas has not been provided

2.5. The site is predominantly flat with an overall fall to the east.

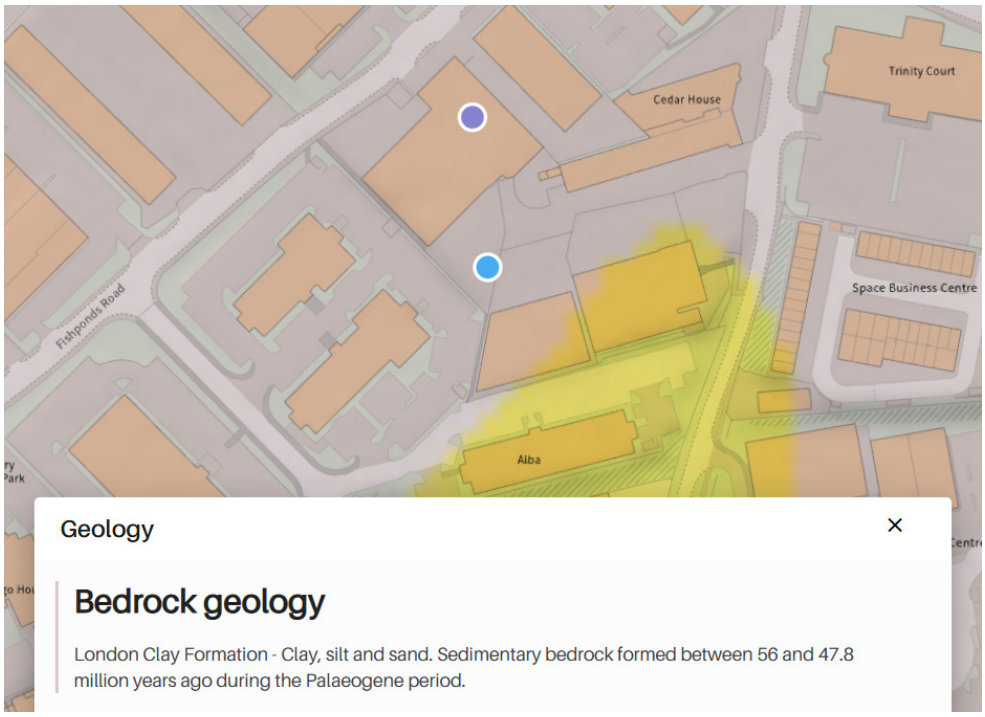
Hydrology

2.6. The site falls within the catchment of Emm Brook which is located approximately 150m to the north east of the site. Emm Brook flows in a northerly direction towards the M4 motorway, the brook then discharges to the River Loddon to the north of Sandford Lake.

Geology

2.7. The published geological information available through the British Geological Society (BGS) online records indicates that the site, in the location of the proposed development, is underlain by bedrock of the London Clay formation. The Bagshot formation is identified beneath the south western corner of the site – refer to **Figure 3**. The site is not underlain by superficial deposits.

Figure 3: BGS Geological Map



Site Investigation

2.8. Intrusive site investigation have not been undertaken specific to the development proposals.

2.9. A ground investigation was undertaken by Hydrock to support planning application 212350 in March 2021. This investigation supported the planning application that comprises the current Apacor Ltd site.

2.10. The existing ground investigation identified:

> *The solid Geology underlying the site comprises the London Clay Formation. No Superficial Deposits are recorded on the site. A significant thickness of Made Ground is anticipated beneath the site associated with the infilling of the historical brick works.*
>
> *Due to the geological nature of the London Clay Formation - Clay, Silt and Sand it is assumed that the ground permeability is poor and not suitable for ground infiltration, however this should be confirmed through on site ground infiltration testing in accordance with BRE Digest 365.*

Existing Drainage

2.11. The site is served by Thames Water foul and surface water sewers. Sewers are located within Fishponds Road to the north west of the site and Eastheath Avenue to the east of the site. Refer to **Appendix C** for Thames Water sewer records

2.12. Refer to **Appendix D** for the foul and surface water strategy drawing that was provided for planning application 212350. It is assumed that the network as detailed was installed and is operational to serve the exiting site area.

2.13. Drainage serving the extended site area existing building and car park area is undetermined.

3. FLOOD RISK

3.1. Inappropriate development in flood risk areas could pose significant risks in terms of personal safety and damage to the property for the occupiers of the development or for people elsewhere. The approach taken in the assessment of flood risk at the planning stage is set out in national, regional and local planning policy and associated guidance. This section summarises the key policies and guidance relevant to the proposed development.

National Planning Policy

National Planning Policy Framework (NPPF)

3.2. The National Planning Policy Framework (NPPF) was first published in 2012, with subsequent revisions by the Ministry of Housing, Communities and Local Government amended in July 2018, February 2019, July 2021 and September 2023, December 2024 with the most recent update being made in February 2025.

3.3. The NPPF is the primary source of national planning guidance in England, setting out the Government's planning policies for England, and how they are expected to be applied by local councils.

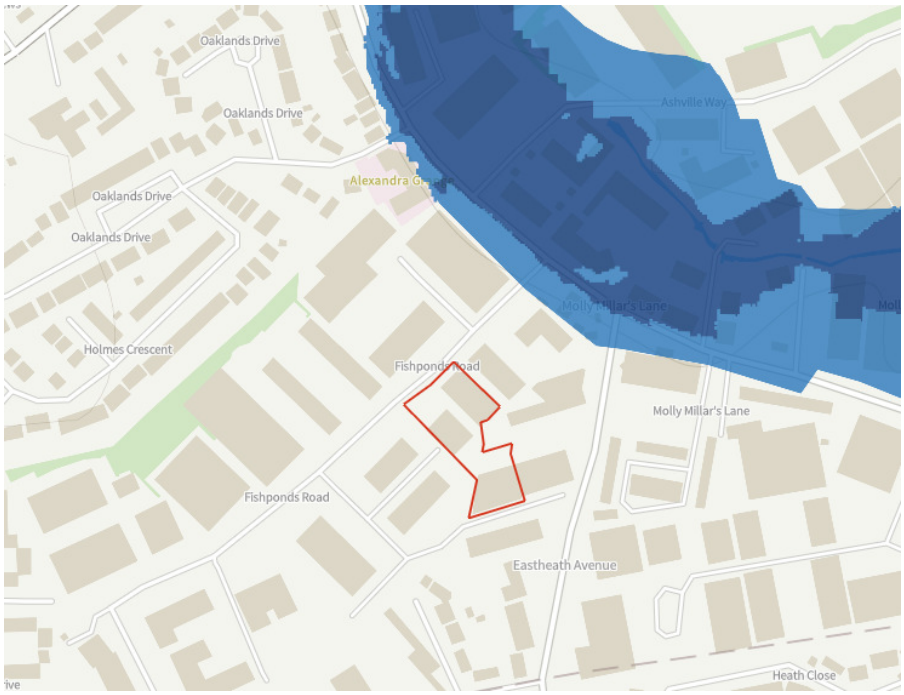
3.4. It is necessary to consider the potential consequences of flooding from all sources, which include directly from pluvial flows, rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

Sources of Flood Risk

Fluvial Flooding

3.5. **Figure 4** provides an extract of the Flood Risk Map for planning which identifies that the site is located in Flood Zone 1.

Figure 4: Environment Agency's Flood Map for Planning



Pluvial Flooding

3.6. The Environment Agency's Risk of Flooding from Surface Water Map indicates where surface water may be expected to flood or pond. Surface water flooding happens when rainwater does not drain away through the normal drainage systems or soak into the ground, but lies on or flows over the ground instead.

3.7. The RoFSW (Risk of Flooding from Surface Water) mapping identifies the following risk levels:

- **High Risk -** Flooding occurring as a result of rainfall with a greater than 1 in 30 chance in any given year (annual probability of flooding 3.3%)
- **Medium Risk -** Flooding occurring as a result of rainfall of between 1 in 100 (1%) and 1 in 30 (3.3%) chance in any given year
- **Low Risk -** Flooding occurring as a result of rainfall of between 1 in 1000 (0.1%) and 1 in 100 (1%) chance in any given year
- **Very Low Risk -** Flooding occurring as a result of rainfall with less than 1 in 1000 (0.1%) **chance in any given year**

3.8. **Figure 5** shows the extent of surface water flood risk. The site is shown to be in an area of surface water ponding primarily located over the existing building. The line that dissects the site in **Figure 5** indicates the area of new works to the southern section – surface water flood risk is apparent within this area.

Figure 5: Risk of Flooding from Surface Water Map (1:1000yr extents)

Flooding from Groundwater

3.9. There are no records of groundwater flooding in the site or the surrounding area. The site is shown to be in an area with a susceptibility of groundwater flooding <25%. The site does not lie within a groundwater emergence zone.

Flooding from Overwhelmed Sewers and Drainage Systems

3.10. There are no recorded flooding incidents from private or adoptable drainage networks

Flooding from Artificial Sources

3.11. The Environment Agency's Risk of Flooding from Reservoirs Map indicates the site is unaffected by flooding from any reservoirs.

Flood Risk Vulnerability

3.12. Annex 3: Flood Risk Vulnerability Classification categorises different types of development according to their vulnerability to flood risk. Table 2: Flood risk vulnerability and flood zone 'compatibility', maps these vulnerability classes against the flood zones to indicate where development is appropriate and where development should not be permitted.

Figure 6: Extract of Annex 3: Flood Risk Vulnerability Classification

Less vulnerable

- Police, ambulance and fire stations which are not required to be operational during flooding.
- Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure.
- Land and buildings used for agriculture and forestry.
- Waste treatment (except landfill* and hazardous waste facilities).
- Minerals working and processing (except for sand and gravel working).
- Water treatment works which do not need to remain operational during times of flood.
- Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.
- Car parks.

3.13. With reference to Annex 3, the proposed residential development is classified to be less vulnerable.

3.14. With reference to NPPF Table 2, the proposed development is appropriate land use in Flood Zone 1.

Figure 7: Table 2: Flood Risk Vulnerability and Flood Zone 'Compatibility'

Table 2: Flood risk vulnerability and flood zone 'incompatibility'

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✔	✔	✔	✔	✔
Zone 2	✔	Exception Test required	✔	✔	✔
Zone 3a †	Exception Test required †	X	Exception Test required	✔	✔
Zone 3b *	Exception Test required *	X	X	X	✔ *

Key:

✔ Exception test is not required

X Development should not be permitted

Sequential Test

3.15. Paragraph 172 of the NPPF states –

> *All plans should apply a sequential, risk-based approach to the location of development – taking into account all sources of flood risk and the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property. They should do this, and manage any residual risk, by:*
>
> *(a) applying the sequential test and then, if necessary, the exception test as set out below;*
>
> *(b) safeguarding land from development that is required, or likely to be required, for current or future flood management;*
>
> *(c) using opportunities provided by new development and improvements in green and other infrastructure to reduce the causes and impacts of flooding, (making as much use as possible of natural flood management techniques as part of an integrated approach to flood risk management); and*
>
> *(d) where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to relocate development, including housing, to more sustainable locations.*

3.16. Paragraph 174 of the NPPF states -

> *Within this context the aim of the sequential test is to steer new development to areas with the lowest risk of flooding from any source. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying this test.*

3.17. The site is located in Flood Zone 1 and is not at risk of flooding from other sources therefore the sequential test is passed.

4. RoFSW MITIGATION

4.1. The Risk of Flooding from Surface Water mapping identifies an area of ponding within the boundary of the site and over the footprint of the Sapphire Centre.

4.2. The new works, as shown in **Appendix A**, will be partially located within the RoFSW extents.

4.3. The RoFSW maps provide information on flood depths to show the chance that different depths of flooding could be reached or exceeded. The chance of flooding beyond the stated depth (for example 20cm) is given as follows:

- 'High' - means more than 3.3% (1 in 30) chance of a flood each year
- 'Medium' - means between 1% (1 in 100) and 3.3% (1 in 30) chance of a flood each year
- 'Low' - means between 0.1% (1 in 1000) and 1% (1 in 100) chance of a flood each year
- 'Very low' - means less than 0.1% (1 in 1000) chance of a flood each year

4.4. Where reviewing the anticipated flood depths, the Environment Agency identifies that there is a low risk chance of 20cm depth of flooding, very low chance of 30cm depth of flooding and very low chance of 60cm depth of flooding.

4.5. Mitigation for the extents and depth of surface water flooding will include the raising of the DPC to main buildings, linear drains to limit water ingress to warehouse areas and implementation of SuDS in the form of permeable paving.

4.6. The general topography of the site shows falls towards the private road to the east of the site – the general topography of the site will be retained

5. SURFACE WATER MANAGEMENT

Design Principles

5.1. Key design principles in the following guidance documents steer the approach to managing surface water runoff at sites:

- Building Regulations hierarchy of drainage (H3);
- Interim Code of Practice for SuDS; and
- CIRIA best practice guidance, including the use of the 'SUDS management train'

5.2. Building Regulations hierarchy of drainage outlines the preferred methods for the disposal of surface water with infiltration methods being the preferred option. If this is not possible the next favoured option is to drain to an existing watercourse. If neither of these options are feasible, the regulations state that rainwater discharge should be directed to a sewer.

5.3. The Interim Code of Practice for SUDS provides guidance about the hydraulic design criteria for Sustainable drainage systems. This in general refers to both peak rate of runoff and the volume of runoff, post development. Prior to mitigation measures such as the use of SuDS attenuation features, both the volume and peak rate of runoff may increase post development.

5.4. The design principles for surface water management extend beyond simple hydraulic criteria. CIRIA guidance promotes the use of the SUDS management train, a concept where SUDS techniques are used to treat, convey and store surface water runoff. This approach is considered as part of the SUDS selection methodology.

Sustainable Drainage Systems

5.5. Peak surface water discharge rates to watercourses and sewers should be appropriately managed and where possible reduced. Preference should always be given to SuDS over the traditional methods of buried sewers wherever possible and practical. Sustainable Drainage Systems (SuDS) can address the four key sustainability objectives including: water quantity, water quality, amenity and biodiversity.

5.6. Promoting SuDS to deal with surface water at the source, will limit the required attenuation and in turn reduce the volume of surface water in the nearby watercourse and sewer infrastructure. There may be the potential to utilise SuDS features for conveyance/attenuation of surface water flows within the proposed drainage strategy, opposed to the traditional below ground storage methods. Detailed design should confirm whether this site would be suitable for incorporation of SuDS following more detailed analysis of levels, ground conditions and attenuation requirements.

Climate Change

5.7. The NPPF requires development to take account of the impacts of climate change. The allowances to be made for climate change effects when assessing flood risk are related to the lifetime of the development.

5.8. The peak rainfall intensity allowances to be used when designing urban drainage systems have been obtained from the environment agencies web based resource tool 'Climate change allowances for peak rainfall' by searching the development management catchment for the surrounding area

5.9. The site is located in the Loddon and Tributaries Management Catchment, the catchment allowances have reproduced in **Table A.** Both the central and upper end allowances need to be assessed to understand the range of impact.

Table A: Peak rainfall intensity allowance

	3.3% Annual exceedance		1% Annual exceedance	
Loddon and tributaries Management Catchment peak rainfall allowances	'2050s' (up to 2060)	'2070s' (2061 to 2125)	'2050s' (up to 2060)	'2070s' (2061 to 2125)
Central	20%	25%	20%	25%
Upper End	35%	35%	40%	40%

5.10. Surface water drainage design will allow for 35% climate change within the 30 year return period storms and 40% for the 100 year return period storms.

Surface Water Flow Balancing

Catchment Areas

5.11. The total red line boundary measures 4790m². This includes the current Apacor office & warehouse building and associated car parking areas (3290m²), and the additional land to the east of the site that comprises of a building and parking area (1500m²).

5.12. The development area of the new warehouse and link building, as depicted in **Appendix A**, measures 2135m² of which 630m² discharges to the exiting surface water drainage network as represented in **Appendix D**, the remaining impermeable area is assumed to have free discharge to private drainage assets located to the east of the site.

Greenfield Runoff Rate

5.13. The 'Wokingham SuDS Strategy' (January 2017) refers to policy CC10: Sustainable Drainage point 2 and states that

> *All development proposals must:*
>
> *a) Reproduce greenfield runoff characteristics and return run-off rates and volumes back to the original greenfield levels, for greenfield sites and for brownfield sites both run-off rates and volumes be reduced to as near greenfield as practicably possible*

5.14. Greenfield runoff rates have been calculated as represented in **Table B** – calculations can be found in **Appendix E**.

Table B: Greenfield Runoff Rates

Return Period (Years)	1	Q_{bar}	30	100
Greenfield Runoff Rates (l/s)	1.8	2.2	5	6.9

Pre development unattenuated Peak Runoff Rate

5.15. The existing site area of 3290m² discharges to the Thames Water Sewers to the west of the site and is limited to 1.5l/s for all storm events which is the equivalent greenfield runoff rate for the site area (refer to planning application 212350).

5.16. The additional catchment area of 1500m² would discharge unattenuated flows which are calculated utilising the modified rational method.

5.17. The following parameters were used to calculate the brownfield runoff from the site.

Q (l/s) = 2.78CiA

Where:

Q = discharge rate

C = Coefficient if discharge

i = mean rainfall intensity (mm/hr)

A = Area (ha) drained hard surfaces

Table C: Pre development site Modified Rational Method permeable runoff

Return Period	Flows from Existing application site (3290m²)	New site area (1500m²)				Total discharge
		C	I	A	Flow (l/s)	
1:1 year	1.5	0.95	28.809	0.15	11.413	12.913
1:30 year	1.5	0.95	70.68	0.15	28.000	29.500
1:100 year	1.5	0.95	91.443	0.15	36.225	37.725

Discharge rate

5.18. In accordance with the 'Wokingham SuDS Strategy' (January 2017), the total discharge from the full development site is not to exceed 1.8l/s for all storm events.

Outfall Location

5.19. In terms of what sort of sustainable drainage system should be considered, paragraph 056 in of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-056-20220825) advises that, generally, the aim should be to discharge surface water runoff as high up the following hierarchy of drainage options as reasonably practicable (also stated within The SuDS Manual CIRIA C753):

- into the ground (infiltration);
- to a surface water body;
- to a surface water sewer, highway drain, or another drainage system;
- to a combined sewer.

Infiltration

5.20. The site comprises of clays which is not suitable to support infiltration SuDS. Infiltration Suds are deemed to not be applicable.

Surface Water body

5.21. There are no watercourses of ditches in the vicinity of the site to permit surface water discharges.

Surface Water Sewer (public, highways or otherwise)

5.22. The existing site has discharge to Thames Water surface water sewers. It is proposed that the redeveloped site retains this approach.

Surface Water Drainage Strategy

5.23. In view of the requirements of the NPPF, PPG, and design parameters and constraints associated with redeveloping this site, a surface water drainage strategy design has been devised and hydraulically modelled to demonstrate that the scheme can be suitably implemented without increasing the level of flood risk, when the surface water drainage system experiences a 1:100-year rainfall event (including 40% allowance for climate change).

5.24. The surface water drainage scheme has been designed to ensure:

- Sustainable Urban Drainage systems are wholly incorporated within the scheme.
- Consideration is given for the improvement of water quality within the design.
- The designed drainage scheme can satisfactorily retain a critical 1 in 100 Year storm event with climate change.

5.25. Surface water drainage is to utilise the existing site outfall with amendments to the existing storage structures and flow control chamber. Additional storage facilities in the form of attenuation tanks and permeable paving are to be added to the east of the site which follows the original surface water methodology

5.26. The surface water strategy entails that the existing surface water network and discharge location is retained and that there is a reduction in flood risk to the private drainage to the east of the site as the development removes catchment from the new eastern area and discharges this into the existing site outfall.

5.27. Refer to drawing 6918-C-SK01 'Drainage Strategy' in **Appendix F** for the layout of the surface water network.

5.28. The hydraulic assessment provides various scenarios up to and included the critical 1 in 100 Year storm event with additional 40% allowance for climate change. The simulations confirm that the storm can be managed and maintained within the site without flooding. The hydraulic models of the proposed surface water network and SuDS devices can be found in **Appendix G**.

Water Quality

5.29. In terms of water quality, the proposed surface water system offers a suitable level of mitigation in accordance with Environment Agency, DEFRA and CIRIA guidance.

5.30. The CIRIA SuDS Manual C753, 2015 details an approach for establishing the hazard posed by the intended land use activities and the extent to which the proposed SuDS components can reduce and mitigate the contamination risk to the receiving waterbody. Referring to Table 26.2 – 'Pollution hazard indices for different land use classifications' (CIRIA C753, 2015) the proposed development and land use results in a low pollution hazard, therefore a 'simple index' method can be used to make a qualitative assessment of the proposed SuDS management.

5.31. To ensure that there is adequate treatment, all SuDS components utilised should have a pollution mitigation index that equals or exceeds the pollution hazard index. In reference to Table 26.2, the pollution hazard index for the commercial roof areas and car parking area are -

TSS = 1.0,

Metals = 0.8,

Hydrocarbons = 0.75.

Figure 8: CIRIA C753, 2015. Table 26.2 – 'Pollution hazard indices for different land use classifications'

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways[1]	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways[1]	High	0.8[2]	0.8[2]	0.9[2]

Notes

1 Motorways and trunk roads should follow the guidance and risk assessment process set out in Highways Agency (2009).

2 These should only be used if considered appropriate as part of a detailed risk assessment – required for all these land use types (Table 4.3). When dealing with high hazard sites, the environmental regulator should first be consulted for pre-permitting advice. This will help determine the most appropriate approach to the development of a design solution.

5.32. In reference to Table 26.3 – 'Indicative SuDS mitigation indices for discharges to surface waters' (CIRIA C753, 2015) the inclusion of permeable paving provides a total mitigation of:

TSS = 0.7, Metals = 0.6 & Hydrocarbons = 0.7

Figure 9: CIRIA C753, 2015. Table 26.3 – 'Indicative SuDS mitigation indices for discharges to surface waters'

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters

	Mitigation indices[1]		
Type of SuDS component	TSS	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4[2]	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond[4]	0.7[3]	0.7	0.5
Wetland	0.8[3]	0.8	0.8
Proprietary treatment systems[5,6]	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

Notes

1 SuDS components only deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters.

2 Filter drains can remove coarse sediments, but their use for this purpose will have significant implications with respect to maintenance requirements, and this should be taken into account in the design and Maintenance Plan.

3 Ponds and wetlands can remove coarse sediments, but their use for this purpose will have significant implications with respect to the maintenance requirements and amenity value of the system. Sediment should normally be removed upstream, unless they are specifically designed to retain sediment in a separate part of the component, where it cannot easily migrate to the main body of water.

4 Where a wetland is not specifically designed to provide significantly enhanced treatment, it should be considered as having the same mitigation indices as a pond.

5 See Chapter 14 for approaches to demonstrate product performance. A British Water/Environment Agency assessment code of practice is currently under development that will allow manufacturers to complete an agreed test protocol for systems intended to treat contaminated surface water runoff. Full details can be found at: **http://tinyurl.com/qf7yuj7**

6 SEPA only considers proprietary treatment systems as appropriate in exceptional circumstances where other types of SuDS component are not practicable. Proprietary treatment systems may also be considered appropriate for existing sites that are causing pollution where there is a requirement to retrofit treatment. SEPA (2014) also provides a flowchart with a summary of checks on suitability of a proprietary system.

5.33. Proprietary devices in the form of catchpits will be installed within the surface water network to trap and contain sediment, pollutants and contaminants such that the necessary water quality treatment requirements can be met.

Exceedance

5.34. Exceedance flows will follow the natural topography of the site and discharge in a south westerly direction. Exceedance flow routes are shown on drawing 6918-C-SK01 in **Appendix F**.

6. SuDS MANAGEMENT & MAINTENANCE PLAN

Management & Maintenance

6.1. Maintenance refers to the inspections required to identify performance issues and plan maintenance as required, operation and maintenance of the drainage system, landscape management and waste management associated with contaminated silt and other waste materials resulting from maintenance.

6.2. CIRIA C753 The SuDS Manual provides information in Chapter 32 for the operation and maintenance of SuDS. The maintenance activities are broadly defined as regular, occasional and remedial maintenance. It is noted that some scenarios may require one-off maintenance activities. The SuDS Manual defines maintenance as –

- Regular Maintenance: consists of basic tasks carried out to a frequent and predictable schedule, including inspections/monitoring, silt or oil removal if required more frequently than once a year, vegetation management, sweeping or surfaces and litter / debris removal.
- Occasional maintenance: comprises tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the regular tasks.
- Remedial maintenance: describes the intermittent tasks that may be required to rectify faults associated with the system, although the likelihood of faults can be minimised with good design, constructions and regular maintenance activities.

6.3. Maintenance regimes are to be reviewed on an annual basis to ensure that the approach adopted is meeting its objectives.

6.4. All those responsible for the maintenance operations should adhere to the relevant health and safety legislation for the activities listed within this report (including lone working, if relevant). Method statements and risk assessments should always be completed prior to the undertaking of any works.

Indicative Maintenance & Management Plan

Gravity Drains & Catchpits

6.5. Maintenance will usually be carried out manually, although a suction tanker can be used for sediment/debris removal. If maintenance is not undertaken for longs periods, deposits can become hard-packed and require more effort to remove.

Permeable Surfaces

6.6. Permeable surfaces including permeable block paving, porous asphalt, gravel or free draining soils that allow rain to percolate through the surface into underlying drainage layers. They must be protected from silt, sand, compost, mulch, etc. Permeable block paving and porous asphalt can be cleaned by suction brushing.

6.7. Regular inspection and maintenance is important for the effective operation of permeable pavements, they should be inspected regularly, preferably during and after heavy rainfall to check effective operation and to identify any areas of ponding.

6.8. Care should be taken in adjusting vacuuming equipment to avoid removal of jointing material. In instances where jointing material is lost, this material this should be replaced immediately.

6.9. Depending on the amount of usage and the environment that the permeable pavement has been exposed to, the laying course material may require either replacement or cleaning after a 25 to 30 year period. This would be evident if the infiltration rate of the paving became prolonged, allowing ponding to develop. If this situation should occur, the uplifting and cleaning (or replacing, depending on the costings of the activity) of the laying course may be considered. The laying course material, jointing and blocks may be reused (once cleaned), to aid in minimising costs.

6.10. Inspection and maintenance of the permeable surfaces will be dependent upon the manufacturer's recommendations and installation as per manufacturers details.

6.11. Table 20.15 of the CIRIA SuDS, reproduced in **Figure 10** below, provide the operation and management requirements of permeable paving.

Figure 10: CIRIA C753, 2015. Table 20.15

TABLE 20.15 Operation and maintenance requirements for pervious pavements

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 surface from adjacent impermeable areas as this area 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 glyphospate 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 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks 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	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Modular Storage

6.12. Modular plastic geocellular systems with a high void ratio, that can be used to create a below ground infiltration (soakaway) or storage structure.

6.13. Regular inspection and maintenance is required to ensure the effective long-term operation of below ground modular storage systems

6.14. Catchpits are installed at the inlet to the tanks to allow for removal of silt / debris as required. The tanks are utilised for the 1:100 year storm event and as such are envisaged to have minimal levels of silt due to the use of permeable paving and gullies within the system.

6.15. Inspection and maintenance of the tanks will be dependent upon the manufacturer's recommendations and installation as per manufacturers details.

6.16. Refer to **Figure 11** for the Operation and Maintenance requirements as stated within CIRIA C753

Figure 11: CIRIA C753, 2015. Table 21.3 – 'Operation and maintenance requirements for attenuation storage tanks

TABLE 21.3 Operation and maintenance requirements for attenuation storage tanks

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 from 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 blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/ or internal forebays	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, outlet, 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

Flow Control Chambers

6.17. The flow control chamber proposed for this site is a Hydro Brake which has no moving parts and are self-activating requiring minimal maintenance. The bypass disc is the only manually operated element and is applicable for use in the event of a blockage or issue with the drainage network. It is recommended that the chamber is inspected monthly for three months after installation and bi-annually thereafter to verify the condition and operation of the unit and check for blockages within the chamber or flow control device.

6.18. Any silt or debris found during inspections should be removed and cleaned out with the use of a sump vacuum cleaner.

6.19. The table below gives a summary of the operation and maintenance requirements for flow control devices –

CONTROL CHAMBERS	
Regular Maintenance	**Frequency**
Check there is no physical damage and that control is functioning. Ensure bypass arrangements are functional. Remove Debris and silt. Undertake inspection after autumnal leaf fall to ensure functionality of control and that there are no blockages	Monthly
Remedial Works	**Frequency**

Repair physical damage if required / replace unit is damaged	As required
Monitoring	**Frequency**
Inspect chamber and flow control units to ensure that they are in good condition and operating as designed.	Annually and after large storms

Blockages & Spillages

Blockage

6.20. In the event of a blockage within the drainage network, the key risk is that of flooding to the surrounding area. The extent and location of flooding is dependent upon the location of the blockage and the associated storm event.

6.21. In the event of a blockage within the network, the network is to be drained down by use of suction equipment and the blockage removed.

6.22. If a blockage does occur and results in flooding, the exceedance flow routes are anticipated to flow in a westerly direction.

Spillages

6.23. Due to the nature of the development, the likelihood of a spillage is minimal.

6.24. Most spillages on development sites are of compounds that do not pose a serious risk to the environment if they enter the drainage in a slow and controlled manner with time available for natural breakdown in a treatment system. Therefore, small spillages of oil, milk or other known organic substances should be removed where possible using soak mats as recommended by the Environment Agency with residual spillage allowed to bio-remediate in the drainage system.

6.25. In the event of a serious spillage, either by volume or of unknown or toxic compounds, then isolate the spillage with soil, turf or fabric and block outlet pipes from chamber(s) downstream of the spillage with a bung. Contact the Environment Agency immediately.

Responsibility

6.26. All drainage and SuDS features are to be private and remain the responsibility of the client

7. FOUL DRAINAGE

Existing Drainage

7.1. Existing drainage serving the Sapphire centre discharges to the west of the site to Thames Water Sewers.

7.2. It is assumed that the existing building to the east had discharge to the foul drainage run that discharges in an easterly direction before connection to Thames Water sewers

Proposed Drainage

7.3. The drainage serving the Sapphire centre is retained.

7.4. The drainage to serve the new building area to the east is proposed to have connectivity to the existing private foul network

8. CONCLUSIONS

8.1. This Flood Risk Assessment and Drainage Strategy is written in relation to a proposed extension to the rear of the existing APACOR facility by connecting with an existing commercial building to the rear, with associated works. at Sapphire Centre, Fishponds Road, Wokingham. The key conclusions are

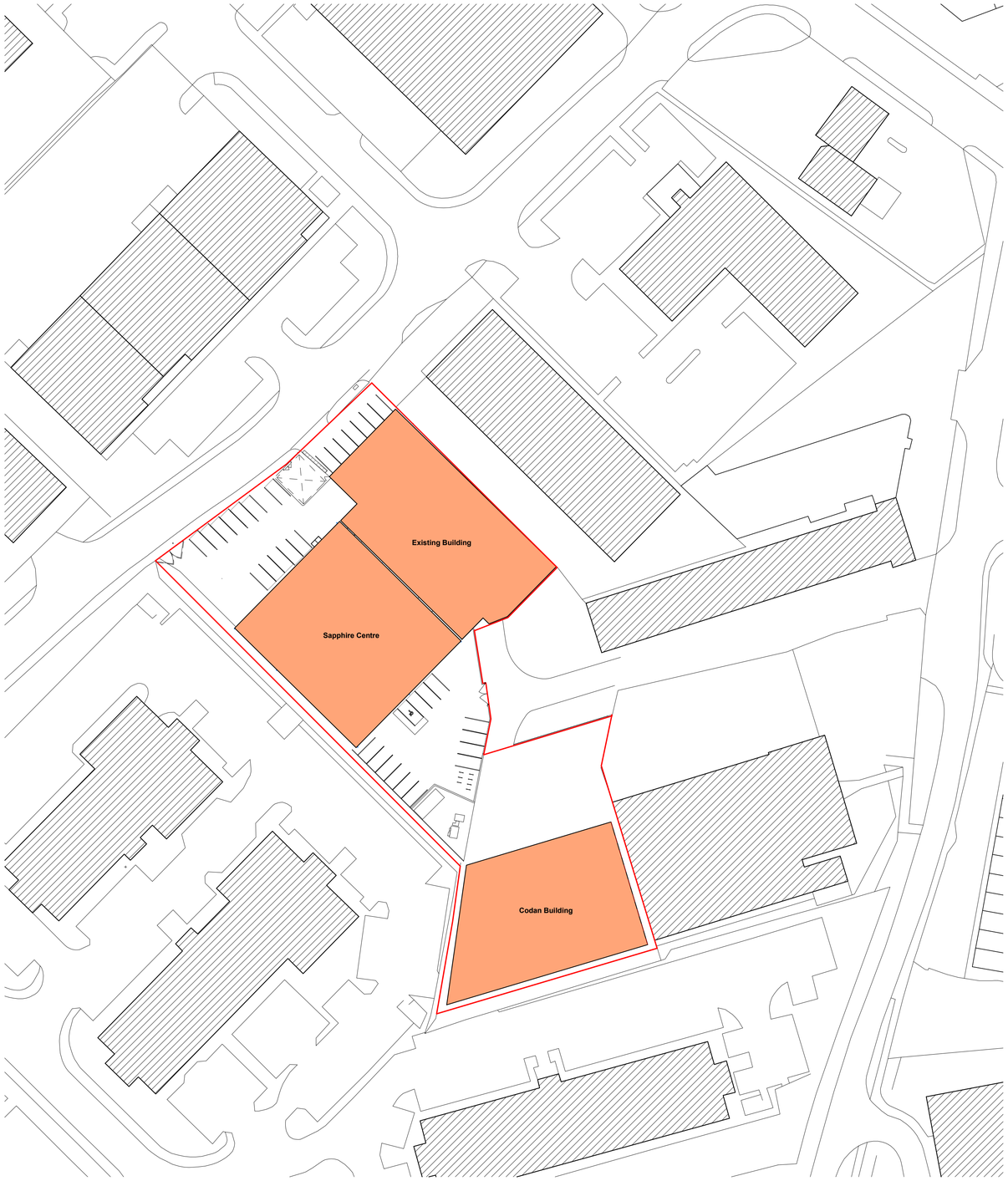
- The site is located in Flood Zone 1
- Surface water flood risk is shown within the vicinity of the site – appropriate mitigation is provided through the implementation of SuDS
- Ground conditions identify clays which will not support infiltration SuDS
- The Sapphire Centre is served by a drainage strategy under previous planning. The new works to the east are to connect to this network and utilise the existing site connectivity whilst providing additional SuDS.
- SuDS are to be provided in the site in the form of permeable paving and an cellular attenuation tank (following the same methodology as the original strategy).

8.2. This report and associated attachments provide sufficient information to prove a viable means of surface water management. This report provides sufficient design and information support the planning application relating to the proposed works.

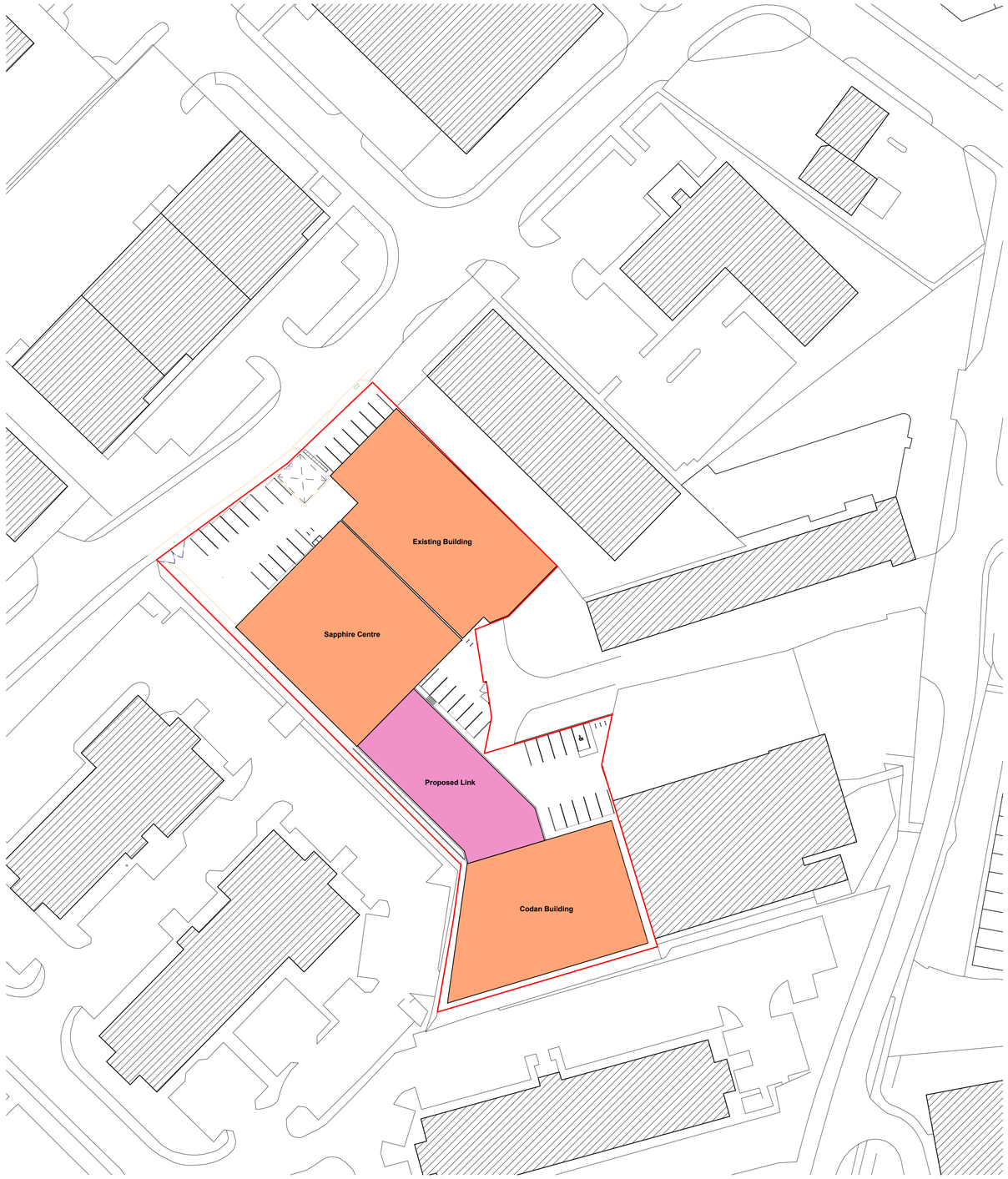
8.3. The overall conclusions drawn from this report is that the development would be appropriately safe for its lifetime taking account of the flood risk vulnerability of its users and the development would not increase flood risk elsewhere through the implementation of an effectivity drainage strategy.

APPENDICES

APPENDIX A



1 Existing Site Block Plan
Scale: 1 : 500



2 Proposed Site Block Plan
Scale: 1 : 500

Disclaimer

This drawing and details contained therein are copyright and are not to be reproduced without obtaining permission. All dimensions and levels relating to actual site conditions are to be checked on site prior to any works being commissioned or executed. Contractors are not to scale from this drawing and should refer any queries in respect of dimensions to the designers.

Notes

These drawings indicate in general the project in terms of Architectural Design Intent to a RIBA Stage 3 level. They are for Tender purposes only and not for Construction. The drawings do not necessarily indicate or describe all work required for full performance and completion of the requirements of the contract documents or full structural, mechanical and electrical systems. As indicated or described, the contractor shall furnish all items required for the full and proper execution and completion of the work.

The Architectural drawings should always be read in conjunction with all other relevant structure and services drawings and any other applicable contract documents. Any discrepancy between these drawings and documents should be reported for clarification and verification. The Architectural drawing is subject to Design Development at RIBA Stages 4 & 5.

N

5 0 5 10 25 m
Metres 1:500

Rev	Notes	Date	Dwn	Iss
00	Issue for Information	19.07.24	ST	ST

Key / Location

STUDIO
TIVOLI
16 Old Town, London SW4 0JY
info@studiotivoli.co.uk

Client
Apacor Ltd
Fishponds Lane
Wokingham
RG41 2QL

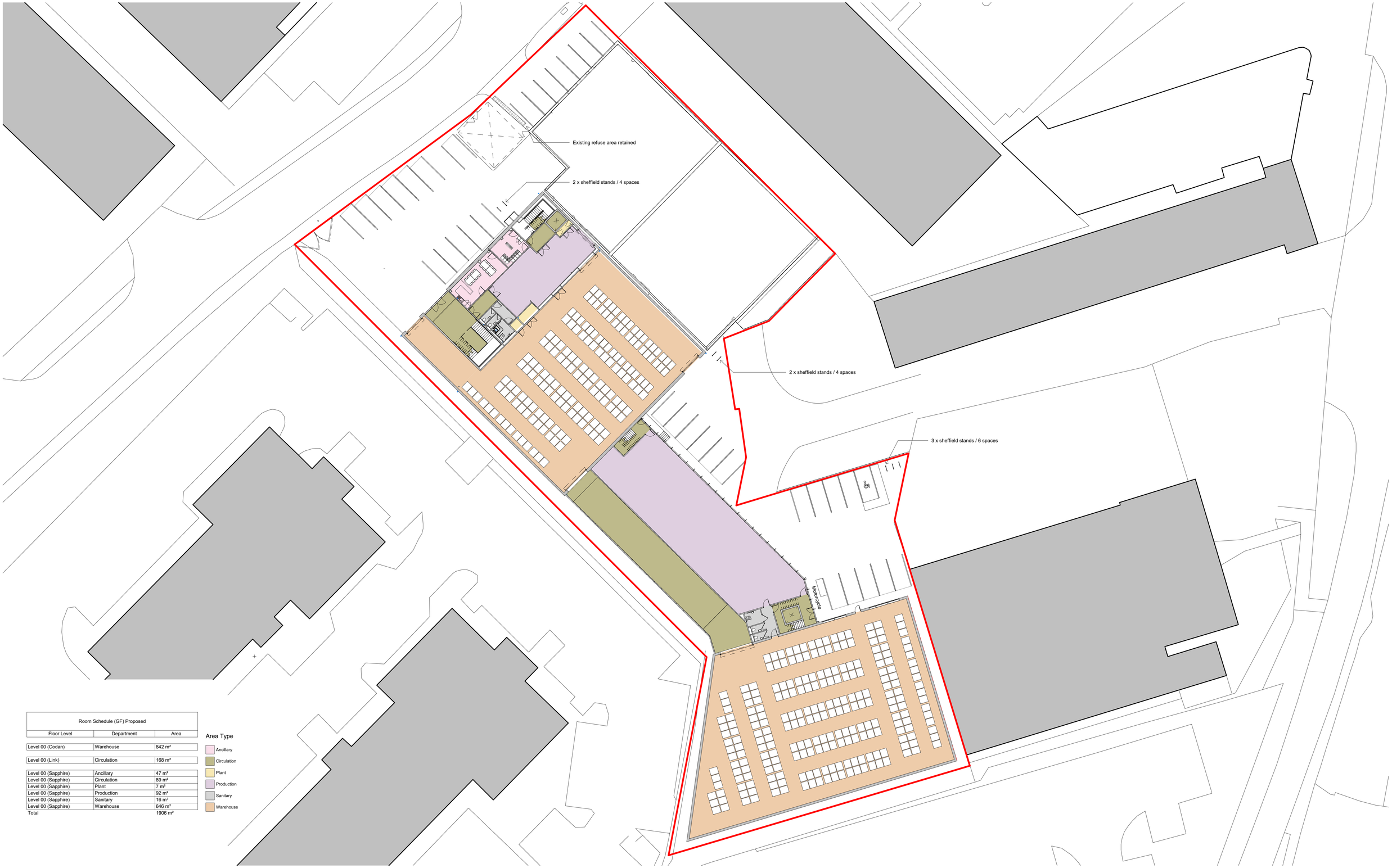
Project
Codan Building

Drawing Title
Site Block Plan

Scale		Drawn By	Issued By
1 : 500	@ A1	ST	ST

For Information

Project No.	Drawing No.	Revision
24014	A_PR_010	00



Room Schedule (GF) Proposed		
Floor Level	Department	Area
Level 00 (Codan)	Warehouse	842 m²
Level 00 (Link)	Circulation	168 m²
Level 00 (Sapphire)	Ancillary	47 m²
Level 00 (Sapphire)	Circulation	89 m²
Level 00 (Sapphire)	Plant	7 m²
Level 00 (Sapphire)	Production	92 m²
Level 00 (Sapphire)	Sanitary	16 m²
Level 00 (Sapphire)	Warehouse	646 m²
Total		1906 m²

Area Type

- Ancillary
- Circulation
- Plant
- Production
- Sanitary
- Warehouse

Disclaimer

This drawing and details contained therein are copyright and are not to be reproduced without obtaining permission. All dimensions and levels relating to actual site conditions are to be checked on site prior to any works being commissioned or executed. Contractors are not to scale from this drawing and should refer any queries in respect of dimensions to the designers.

Notes

These drawings indicate in general the project in terms of Architectural Design Intent to a RIBA Stage 3 level. They are for Tender purposes only and not for Construction. The drawings do not necessarily indicate or describe all work required for full performance and completion of the requirements of the contract documents or full structural, mechanical and electrical systems. As indicated or described, the contractor shall furnish all items required for the full and proper execution and completion of the work.

The Architectural drawings should always be read in conjunction with all other relevant structure and services drawings and any other applicable contract documents. Any discrepancy between these drawings and documents should be reported for clarification and verification. The Architectural drawing is subject to Design Development at RIBA Stages 4 & 5.

N

2.5 0 2.5 5 12.5 m
Metres 1:250

Rev	Notes	Date	Dwn	Iss
00	Issue for Information	13.06.24	ST	ST
01	Issue for Information	19.06.24	ST	ST
02	Issue for Information	19.07.24	ST	ST

Key / Location

STUDIO
TIVOLI
16 Old Town, London SW4 0JY
info@studiotivoli.co.uk

Client
Apacor Ltd
Fishponds Lane
Wokingham
RG41 2QL

Project
Codan Building

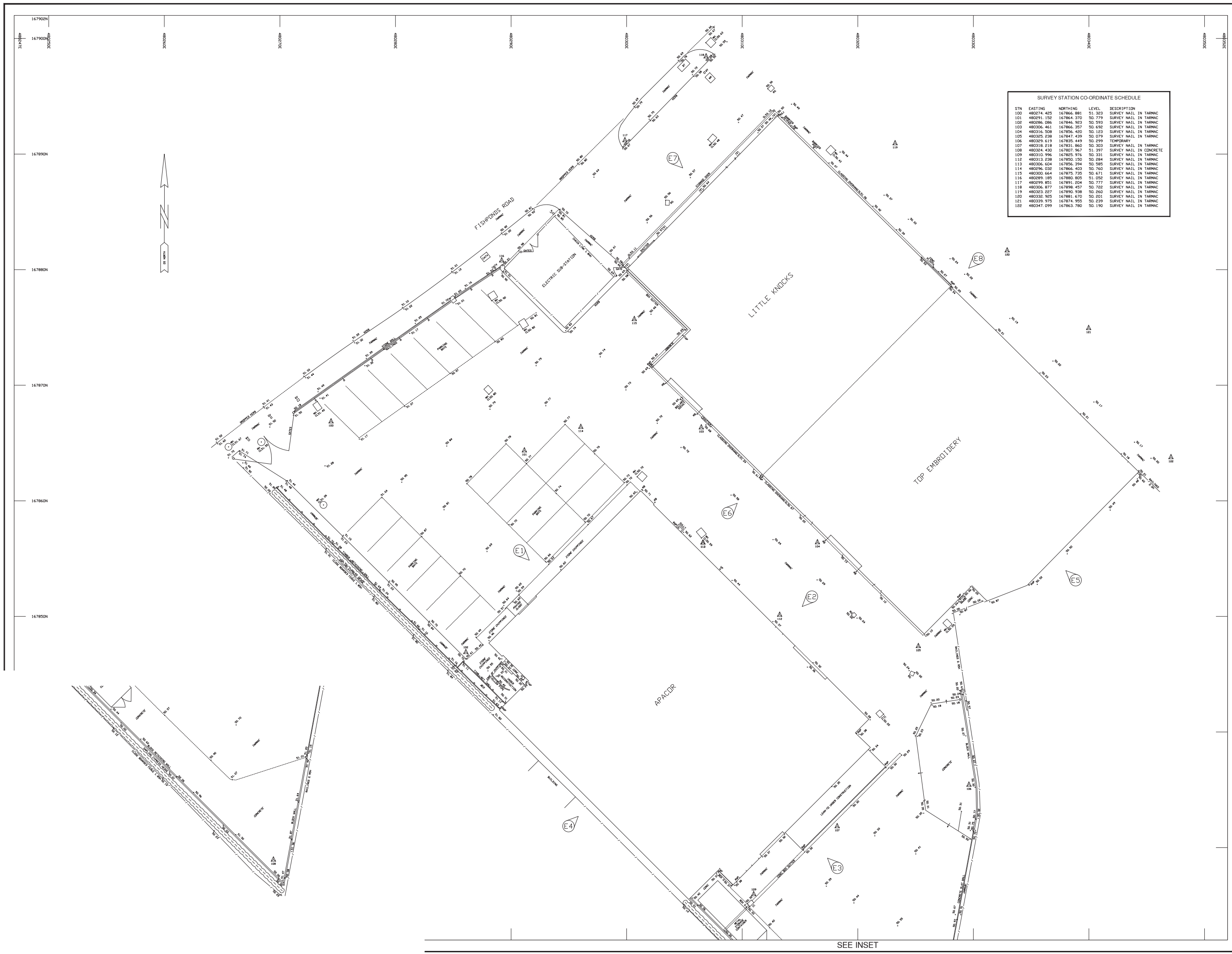
Drawing Title
Area Plan - Proposed Ground Floor

Scale	Drawn By	Issued By
1 : 250 @ A1	ST	ST

For Information

Project No.	Drawing No.	Revision
24014	A_11_100	02

APPENDIX B



SURVEY STATION CO-ORDINATE SCHEDULE

STN	EASTING	NORTHING	LEVEL	DESCRIPTION
100	480274.425	167866.881	51.323	SURVEY NAIL IN TARMAC
101	480291.152	167864.370	50.779	SURVEY NAIL IN TARMAC
102	480286.086	167846.923	50.593	SURVEY NAIL IN TARMAC
103	480306.461	167866.357	50.692	SURVEY NAIL IN TARMAC
104	480316.509	167856.420	50.123	SURVEY NAIL IN TARMAC
105	480325.238	167847.439	50.079	SURVEY NAIL IN TARMAC
106	480329.619	167835.449	50.299	TEMPORARY
107	480318.218	167831.860	50.303	SURVEY NAIL IN TARMAC
108	480324.430	167807.967	51.397	SURVEY NAIL IN CONCRETE
109	480310.996	167825.976	50.331	SURVEY NAIL IN TARMAC
112	480313.238	167850.150	50.284	SURVEY NAIL IN TARMAC
113	480306.604	167856.394	50.585	SURVEY NAIL IN TARMAC
114	480296.032	167866.403	50.760	SURVEY NAIL IN TARMAC
115	480300.664	167875.735	50.671	SURVEY NAIL IN TARMAC
116	480289.185	167880.805	51.052	SURVEY NAIL IN TARMAC
117	480299.851	167891.204	50.777	SURVEY NAIL IN TARMAC
118	480306.877	167898.457	50.722	SURVEY NAIL IN TARMAC
119	480323.227	167890.938	50.260	SURVEY NAIL IN TARMAC
120	480332.925	167881.670	50.201	SURVEY NAIL IN TARMAC
121	480339.975	167874.955	50.239	SURVEY NAIL IN TARMAC
122	480347.099	167863.780	50.190	SURVEY NAIL IN TARMAC

SURVEYED BY

STERLING surveys

SUITE 3, UNIT 3, IVONHANGER FARM BUSINESS PARK, IVONHANGER, HAMPSHIRE, GU34 5AL
TEL: 01420 86837 - FAX: 01420 86838
Email: surveys@sterling-surveys.co.uk Internet: www.sterling-surveys.co.uk

JOB No 511783

LEGEND

Survey Station
Direction of Floorboards
Step Up
Banking
Fence
Hedge
Foul Drainage (100mm Pipe)
Storm Drainage (100mm Pipe)
Electricity O/H
Electricity U/G
Central Heating
Bench Mark
Level Position +76.72
Sloping Ceiling
Sloping Masonry
Gates
Grass Shrub Hedge Tree Stump
Telecom O/H
Telecom U/G
Fresh Water (100mm Pipe)
Gas (100mm Pipe)
Change in Ceiling Height

FENCE TYPES

BW	Barbed Wire	IR	Iron Railings
CB	Close Boarded	LL	Larch Lap
CI	Corrugated Iron	PR	Post and Rail
CLK	Chain Link	PW	Post and Wire
CPG	Chestnut Paling	OB	Open Boarded
INT	Interwoven	WM	Wire Mesh

ABBREVIATIONS (Where Applicable)

BOL	Bollard	MR	Metal Railings
BT	British Telecom IC	NB	Notice Board
BRW	Brick Wall	NFI	No Further Info.
BRRW	Brick Ret Wall	O/H	Overhead
CATV	Cable TV	R	From Records
CE	Cleaning Eye	RG	Road Gully
CL	Cover Level	RNB	Road Name Board
CP	Catch Pit	RS	Road Sign
CPS	Conc Paving Slabs	RSJ	Rolled Steel Joist
D	Door	RW	Retaining Wall
DP	Down Pipe	RWP	Rain Water Pipe
ECP	Elec Cable Pit	SA	Soakaway
E.J.B	Elec Junct Box	SC	Stop Cock
EP	Electricity Pole	SP	Sign Post
ERP	Earthing Point	STRW	Stone Ret Wall
FB	Flower Bed	SV	Sluice Valve
FH	Fire Hydrant	TR	Trunking
FIG	Feeds Into Ground	TLT	Traffic Light
G	Gully	TP	Telephone Pole
GM	Gas Meter	TPS	Tactile Paving Slabs
GSC	Gas Stop Cock		
GV	Gas Valve	U/G	Underground
H	High/Height	UTL	Unable To Lift
IC	Inspection Cover	V	Vent
IL	Invert Level	VP	Vent Pipe
KO	Kerb Outlet	W	Window
LP	Lamp Post	WHB	Wash Hand Basin
MB	Metal Bollard	WL	Wall Level
MC	Mercury IC	WSC	Water Stop Cock
MH	Manhole	WM	Water Meter
MKR	Marker	WV	Water Valve

BUILDING

AHL	Arch Head Level	FL	Floor Level
ASL	Arch Springer Level	LL	Landing Level
BSL	Beam Soffit Level	RL	Ridge Level
CBSL	Clad Beam Soffit Level	SL	Soffit Level
		TL	Threshold Level
CIH	Change In Height of Ceiling	TSL	Trunking Soffit Level
CSL	Ceiling Soffit Level	VASL	Window Arch Springer Level
DHL	Door Head Level		
DSL	Duct Soffit Level	WAHL	Window Arch Head Level
EL	Eaves Level		
FCSL	False Ceiling Soffit Level	WSL	Window Sill Level
		WHL	Window Head Level

NOTES

LEVEL DATUM OS DATUM NEWLYN

BY GPS, TRANSFORMED USING OSGM15.

GRID

THE SURVEY GRID WAS OBTAINED BY GPS USING A ONE-STEP TRANSFORMATION FROM ORDNANCE SURVEY NATIONAL GRID AT STATION 100 USING OSTN15.

REV	DATE	PREV JOB NO.	REVISION DETAILS

APACOR LTD
FISHPONDS ROAD
WOKINGHAM
BERKSHIRE
RG41 2QL

JOB TITLE

APACOR LTD
FISHPONDS ROAD
WOKINGHAM
BERKSHIRE

DRAWING TITLE

SITE SURVEY

DRAWING 1 OF 1		AUTOCAD DRAWING FILE NAME		
● 2D	○ 3D	APACOR-SITE.DWG		
SCALE 1/100 @ A0		REVISION SUFFIX		
SHEET SIZE A0-1189x841mm	DATE OCT 2019	SURVEYOR MTGS	DRAWN MTGS	CHECKED PWW

APPENDIX C

Asset Location Search

Property Searches

SDS Consulting
10 ORCHARD GARDENS,
PURTON
SN5 4EJ

Search address supplied Apacor Ltd
Unit 1-5
Sapphire Centre
Wokingham
RG41 2QL

Your reference 6918

Our reference ALS/ALS Standard/2025_5143507

Search date 2 April 2025

Keeping you up-to-date

We have a new website and email address

Website URL: thameswater.co.uk/propertysearches

Email address: property.searches@thameswater.co.uk

Please do get in contact with us if you have any questions.

Thames Water Utilities Ltd
Property Searches,
Clearwater Court, Vastern Road, Reading RG1 8DB

property.searches@thameswater.co.uk
thameswater.co.uk/propertysearches

0800 009 4540

Asset Location Search

Property Searches

Search address supplied: Apacor Ltd, Unit 1-5, Sapphire Centre, Wokingham, RG41 2QL

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This search provides maps showing the position and size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0800 009 4540, or use the contact details below:

Thames Water Utilities Ltd
Property Searches
Clearwater Court
Vastern Road
Reading
RG1 8DB

Email: property.searches@thameswater.co.uk
Web: thameswater.co.uk/propertysearches

Waste Water Services

Please provide a copy extract from the public sewer map.

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority. Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners. The public sewer map relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus. The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an ‘as constructed’ record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

With regard to the fresh water supply, this site falls within the boundary of another water company. For more information, please redirect your enquiry to the following address:

South East Water
Rocfort Road

Snodland
Kent
ME6 5AH

Tel: 0845 301 0845

www.southeastwater.co.uk.

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. You can do this by emailing customer.feedback@thameswater.co.uk with the email subject header 'Enquiry – TWOSA', along with details of the request.

If you have any questions regarding sewer connections, budget estimates, diversions or building over issues please direct them to our service desk which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

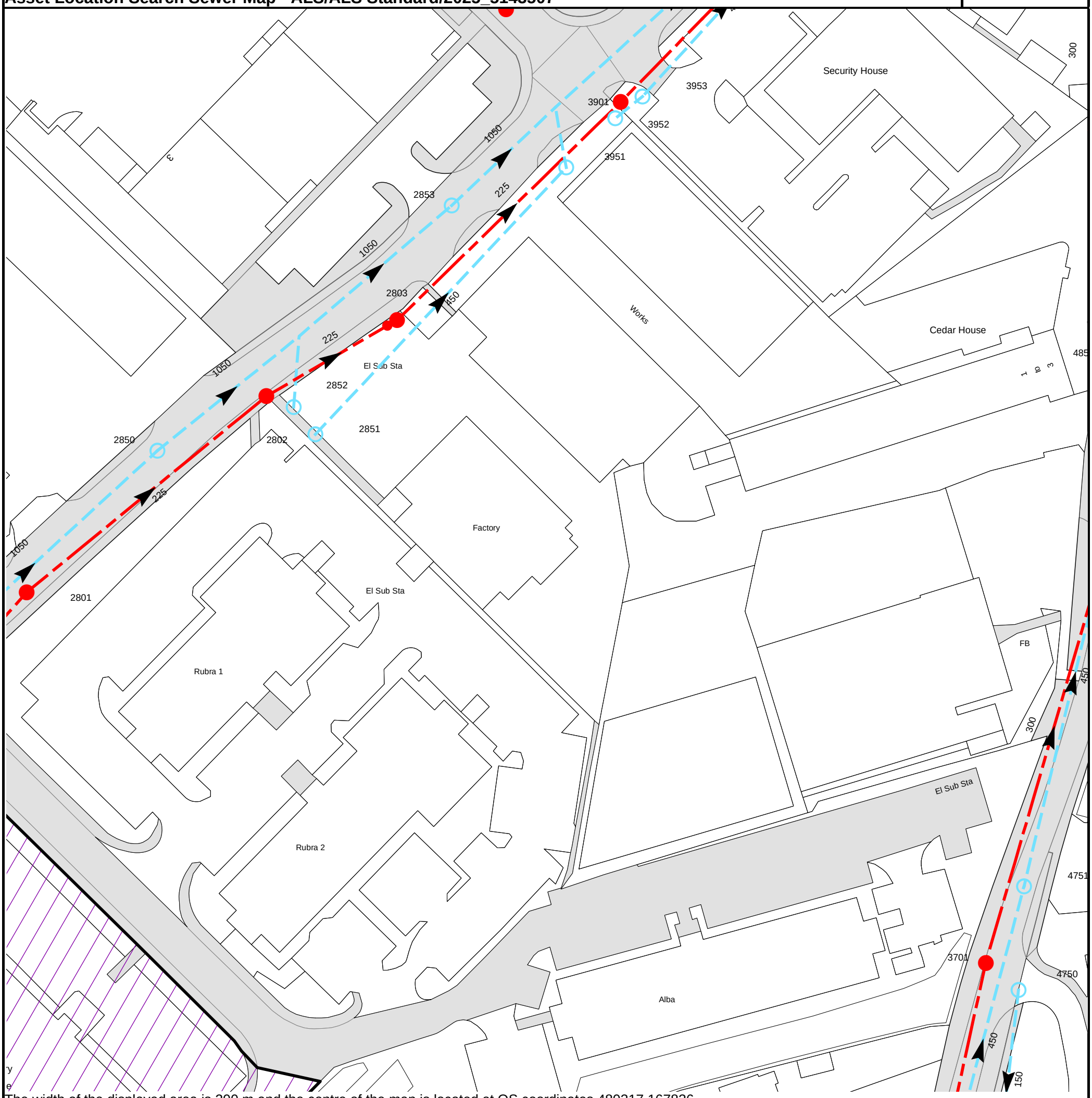
Clean Water queries

Should you require any advice concerning clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2025_5143507



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 480317,167836

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.

Based on the Ordnance Survey Map (2024) with the Sanction of the controller of H.M. Stationery Office, License no. AC0000849556 Crown Copyright Reserved.

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

Manhole Reference	Manhole Cover Level	Manhole Invert Level
3701	54.52	52.35
4751	n/a	n/a
4750	54.88	53.22
2852	51.56	49.14
2851	51.63	49.12
2803	50.89	48.3
2853	50.71	48.34
3902	50.32	47.81
3951	50.46	48.5
3952	n/a	n/a
3901	50.38	47.57
3953	49.98	48.34
2801	52.57	50.51
2850	52.1	48.78
2802	51.64	50.09

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.

Asset Location Search - Sewer Key

Public Sewer Types (Operated and maintained by Thames Water)

Foul Sewer: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water Sewer: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined Sewer: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

- Storm Sewer
- Sludge Sewer
- Foul Trunk Sewer
- Surface Trunk Sewer
- Combined Trunk Sewer
- Foul Rising Main
- Surface Water Rising Main
- Combined Rising Main
- Vacuum
- Thames Water Proposed
- Vent Pipe
- Gallery

Other Sewer Types (Not operated and maintained by Thames Water)

- Sewer
- Culverted Watercourse
- Proposed
- Decommissioned Sewer
- Content of this drainage network is currently unknown
- Ownership of this drainage network is currently unknown

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

- Air Valve
- Meter
- Dam Chase
- Vent
- Fitting

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

- Ancillary
- Drop Pipe
- Control Valve
- Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol. Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

- Inlet
- Outfall
- Undefined End

Other Symbols

Symbols used on maps which do not fall under other general categories.

- Change of Characteristic Indicator
- Public / Private Pumping Station
- Invert Level
- Summit

Areas

Lines denoting areas of underground surveys, etc.

- Agreement
- Chamber
- Operational Site

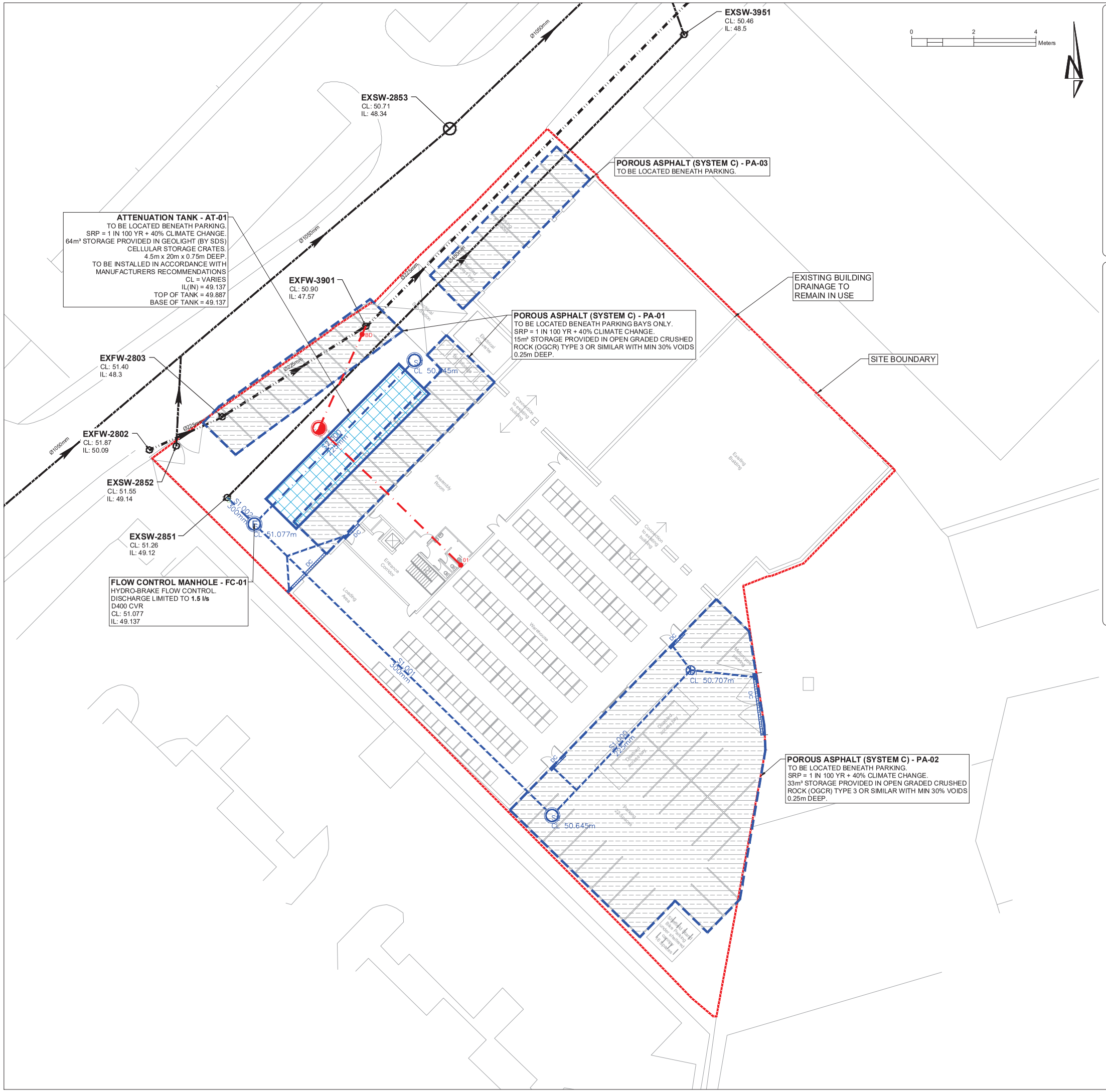
Ducts or Crossings

- Casement — Ducts may contain high voltage cables. Please check with Thames Water.
- Conduit Bridge
- Subway
- Tunnel

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plan are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate the direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
5) 'na' or '0' on a manhole indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimeters. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology, please contact Property Searches on 0800 009 4540.

APPENDIX D



LEGEND - DRAINAGE STRATEGY

PROPOSED DRAINAGE - FOUL

- FOUL WATER DRAIN
- FOUL WATER MANHOLE
- FOUL WATER INSPECTION CHAMBER
- FOUL WATER SHALLOW ACCESS CHAMBER
- YG — FOUL YARD GULLY
- FD — FLOOR DRAIN
- 01 — FOUL OUTLET / STACK POSITION (Refer to Service Engineer / Architect for Details) (Shown indicative)

PROPOSED DRAINAGE - STORM

- STORM WATER DRAIN
- STORM WATER MANHOLE
- STORM WATER INSPECTION CHAMBER
- RG — ROAD GULLY
- PG — 'PAVED AREA' GULLY
- YG — YARD GULLY
- RWO — RAIN WATER DOWNPIPE
- DC — DRAINAGE CHANNEL
- PERFORATED PIPE

NOTE: DRAINAGE HAS ONLY BEEN SHOWN INDICATIVELY TO DEMONSTRATE THE PRINCIPLES OF THE DRAINAGE STRATEGY AND SHOULD NOT BE USED FOR PRICING

PUBLIC EXISTING DRAINAGE SHOWN INDICATIVELY

- 150Ø@1:100 — EXISTING PUBLIC FOUL SEWER
- 150Ø@1:100 — EXISTING PUBLIC STORM SEWER

NOTE:
SETTING OUT OF ALL RWP, STUB-STACK AND SVP POSITIONS TO BE CONFIRMED BY ARCHITECT/M&E

NOTE:
EXISTING DRAINAGE ARRANGEMENT, INVERT LEVELS AND CONDITION TO BE VERIFIED BY CCTV SURVEYS

NOTE:
THE INFORMATION SHOWN IS SUBJECT TO LLFA AND THAMES WATER APPROVAL

NOTE:
EXISTING PUBLIC SEWER INFORMATION AS TAKEN FROM THAMES WATER RECORDS AND SHOWN INDICATIVELY

KEY PLAN

NOTES

1. All dimensions are to be checked on site before the commencement of works. Any discrepancies are to be reported to the Architect & Engineer for verification. Figured dimensions only are to be taken from this drawing.
2. The DWG file is issued for the purposes of coordination only and do not represent formal drawing issue and are not to be reprinted in any form. Formal issue of drawings is via DWF, Adobe PDF files and/or hard copies and their associated information issue sheets.
3. Note that all care has been taken with the export of DWG files and their content, but we recommend that you make due dimensional checks before using any DWG file information. Any errors found are to be reported to Hydrock immediately.
4. All levels are shown in metres above Ordnance Datum (m AOD).
5. All private drainage to comply with current Building Regulations, BS EN-752 Drain and Sewer systems outside Buildings and other relevant British Standards and Codes of Practices.
6. Drainage pipework routes under building footprint will require Co-ordination with foundations.
7. Final foul pipe connection routes and manholes are subject to confirmation of above ground drainage design discharge points at ground level by others to allow final pipe sizes, configuration and connections.
8. Door threshold drainage channel requirements to be advised by others.
9. Surface water drainage RWP locations to be confirmed by Architect.
10. External levels shown on this drawing relating to the civils, drainage works etc are to be confirmed on receipt of final external levels drawing (by others).
11. Foul drainage shown indicative subject to detailed design.

REV	REVISION NOTES/COMMENTS					
	DRAWN BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE
P01	PLANNING ISSUE					
	J. ZYLINSKI	02/07/21	J. MAGEE	02/07/21	M. GRIFFIN	02/07/21

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Wapping Road
Bristol
BS1 4RW
t: +44 (0)117 945 9225
e: bristolcentral@hydrock.com

CLIENT
CLIENT_NAME/LOGO

PROJECT
SAPPHIRE CENTRE

TITLE
DRAINAGE STRATEGY

HYDROCK PROJECT NO.	SCALE @ A1
C-18740-C	1:200

STATUS DESCRIPTION	STATUS
PLANNING	S2

DRAWING NO. (PROJECT CODE-ORGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER)	REVISION
18740-HYD-00-ZZ-DR-C-7000	P01

APPENDIX E

Greenfield runoff rate estimation tool

hr wallingford

www.uksuds.com | Greenfield runoff rate estimation tool (https://www.uksuds.com/)

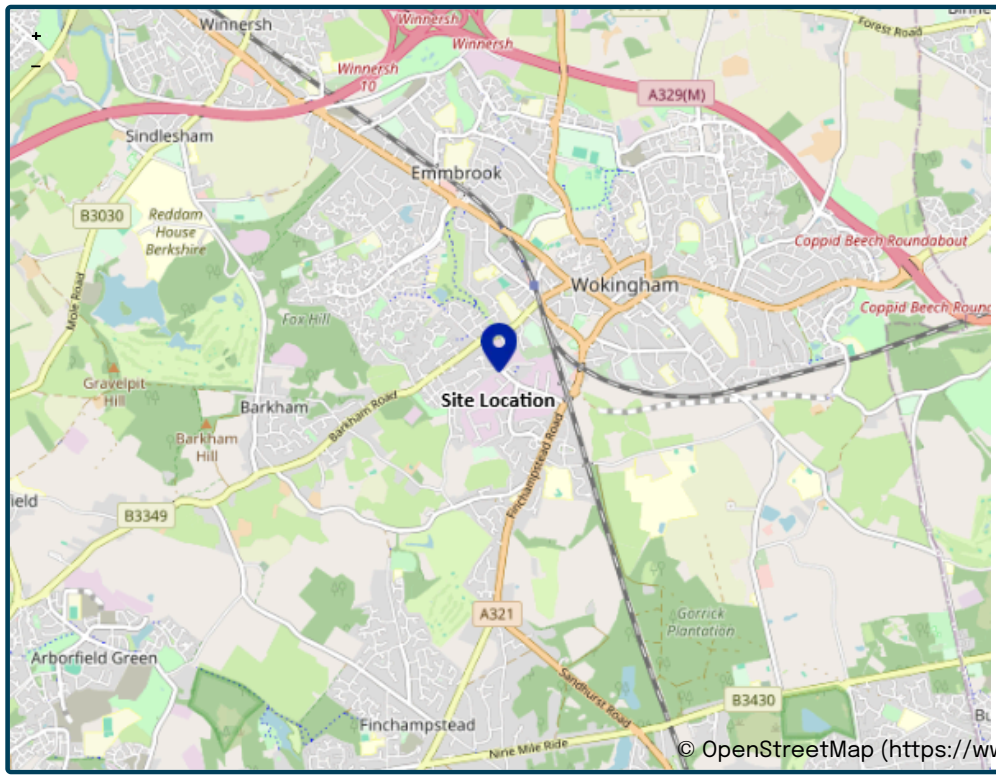
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Project details

Date	03/04/2025
Calculated by	Mark Dyer
Reference	6918
Model version	0.6.5

Location

Site name	Sapphire Centre
Site location	Wokingham



© OpenStreetMap (https://www.openstreetmap.org/copyright) contributors.

Site easting	480300
Site northing	167848

Site details

Total site area (ha)	0.479 ha

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MORE INFO

Greenfield runoff

Method

Method	IH124

IH124

	My value		Map value
SAAR (mm)	659	mm	659
How should SPR be derived?	WRAP soil type		
WRAP soil type	4		4
SPR	0.47		0.47
QBar (IH124) (l/s)	2.2	l/s	

Growth curve factors

	My value	Map value
Hydrological region	6	6
1 year growth factor	0.85	
2 year growth factor	0.88	
10 year growth factor	1.62	
30 year growth factor	2.3	
100 year growth factor	3.19	
200 year growth factor	3.74	

Results

Method	IH124	
Flow rate 1 year (l/s)	1.8	l/s
Flow rate 2 year (l/s)	1.9	l/s
Flow rate 10 years (l/s)	3.5	l/s
Flow rate 30 years (l/s)	5	l/s
Flow rate 100 years (l/s)	6.9	l/s
Flow rate 200 years (l/s)	8.1	l/s

Disclaimer

This report was produced using the Greenfield runoff rate estimation tool (0.6.5) developed by HR Wallingford and available at uksuds.com (https://www.uksuds.com/). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at uksuds.com/terms-conditions (https://www.uksuds.com/terms-conditions). The outputs from this tool have been used to estimate Greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, Centre for Ecology and Hydrology, Wallingford Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

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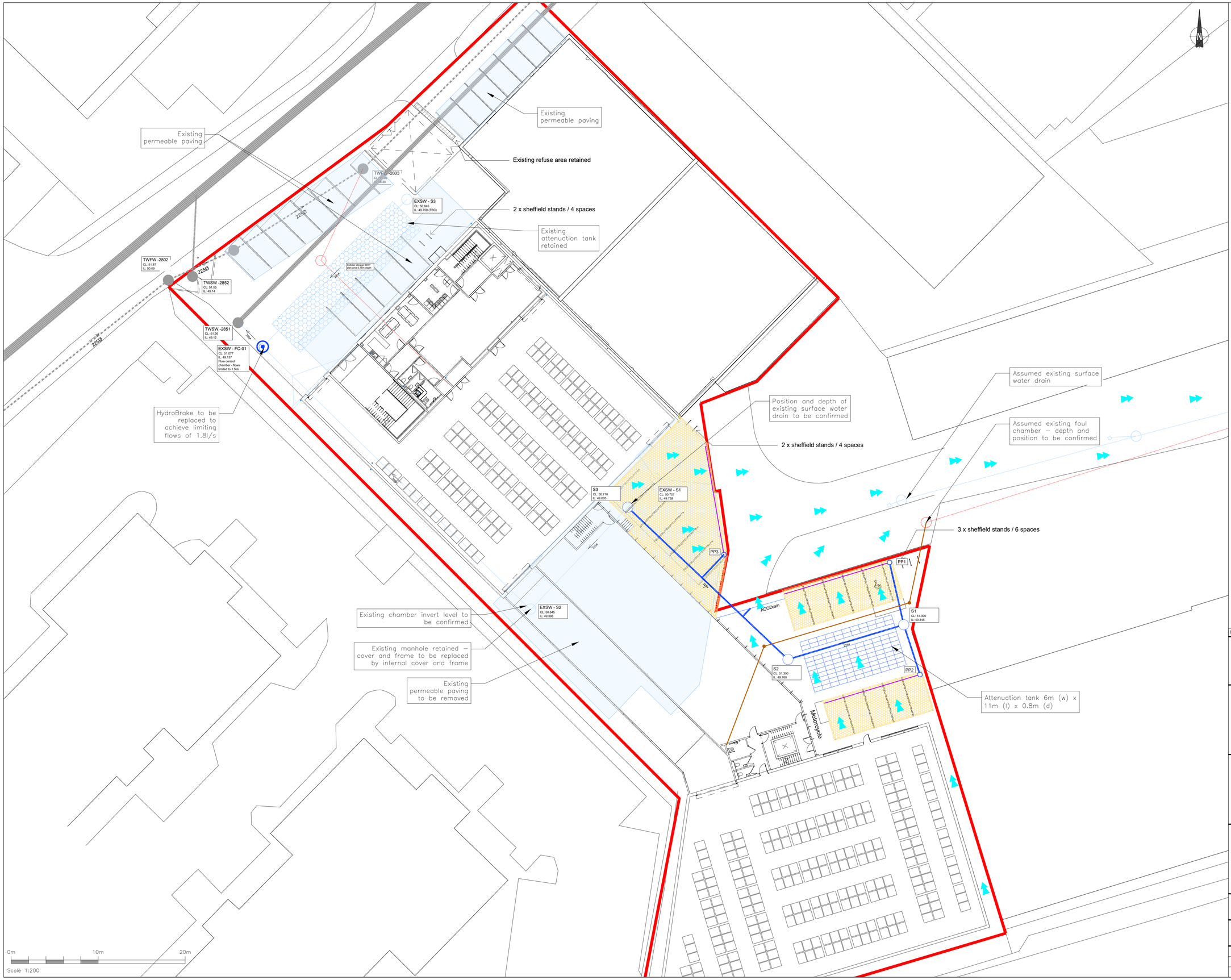
APPENDIX F



NOTES:

1. Drawing for information only – not for construction

KEY:

Existing Drainage

- Existing Thames Water Foul Water Sewer
- Existing Thames Water Surface Water Sewer
- Existing Private Foul Water Drain
- Existing Private Surface Water Drain

Proposed Drainage

- Foul Water Drain
- Surface Water Drain
- SUDS Permeable Paving (Tanked) – Light Duty Construction
- Filter drain and permeable paving outlet
- Exceedance Route Arrow

Rev	Date	Description	Initials	Check

SDS consulting
civil & structural engineers

CLIENT:

APACOR Ltd
c/o LPC (Trull) Ltd

PROJECT

SAPPHIRE CENTRE, FISHPONDS ROAD, WOKINGHAM

DRAWING

DRAINAGE STRATEGY

Drawing No. 6918-C-SK01

Status **For Planning**

Not for Construction

Job Number	6918	Date	APR 2025
Scale	1:200 @ A1		
Drawn By	MTD	Checked By	TL

APPENDIX G

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	30	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)	1.200
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)
PP1	0.019	5.00	51.000	450	450	480350.245	167832.507	1.000
PP2	0.042	5.00	51.300	450	450	480353.742	167819.623	1.000
S1			51.300	1200		480351.952	167825.278	1.455
S2	0.112	5.00	51.300	1200		480338.576	167821.368	1.540
EXSW-S1	0.023	5.00	50.700	1200		480323.319	167842.181	0.962
PP3	0.017	5.00	50.707	450	450	480331.044	167833.925	0.907
S3			50.710	1200		480320.157	167838.850	1.105
EXSW-S2	0.023	5.00	50.645	1200		480308.992	167827.153	1.247
EXSW-S3	0.051	5.00	50.845	1200		480294.769	167874.223	1.095
EXSW-FC01	0.051	5.00	51.077	1200		480278.188	167857.294	1.940
TWSW-2851			51.260	1200		480275.424	167860.067	2.139

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	PP1	S1	7.428	0.600	50.000	49.920	0.080	92.9	150	5.12	50.0
2.000	PP2	S1	5.932	0.600	50.300	49.920	0.380	15.6	150	5.04	50.0
1.001	S1	S2	13.936	0.600	49.845	49.760	0.085	164.0	225	5.35	50.0
1.002	S2	S3	25.395	0.600	49.760	49.605	0.155	163.8	225	5.76	50.0
3.000	EXSW-S1	S3	4.592	0.600	49.738	49.605	0.133	34.5	225	5.03	50.0
4.000	PP3	S3	11.949	0.600	49.800	49.680	0.120	99.6	150	5.20	50.0
1.003	S3	EXSW-S2	16.170	0.600	49.605	49.398	0.207	78.1	225	5.94	50.0
1.004	EXSW-S2	EXSW-FC01	43.097	0.600	49.398	49.137	0.261	165.1	300	6.53	50.0
5.000	EXSW-S3	EXSW-FC01	23.696	0.600	49.750	49.212	0.538	44.0	225	5.20	50.0
1.005	EXSW-FC01	TWSW-2851	3.915	0.600	49.137	49.121	0.016	244.7	300	6.60	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)
1.000	1.043	18.4	2.6	0.850	1.230	0.019	0.0
2.000	2.562	45.3	5.7	0.850	1.230	0.042	0.0
1.001	1.018	40.5	8.3	1.230	1.315	0.061	0.0
1.002	1.019	40.5	23.4	1.315	0.880	0.173	0.0
3.000	2.234	88.8	3.1	0.737	0.880	0.023	0.0
4.000	1.007	17.8	2.3	0.757	0.880	0.017	0.0
1.003	1.481	58.9	28.9	0.880	1.022	0.213	0.0
1.004	1.221	86.3	32.0	0.947	1.640	0.236	0.0
5.000	1.976	78.6	6.9	0.870	1.640	0.051	0.0
1.005	1.000	70.7	45.8	1.640	1.839	0.338	0.0

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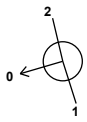
Pipeline Schedule

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	7.428	92.9	150	1 STANDARD	51.000	50.000	0.850	51.300	49.920	1.230
2.000	5.932	15.6	150	1 STANDARD	51.300	50.300	0.850	51.300	49.920	1.230
1.001	13.936	164.0	225	1 STANDARD	51.300	49.845	1.230	51.300	49.760	1.315
1.002	25.395	163.8	225	1 STANDARD	51.300	49.760	1.315	50.710	49.605	0.880
3.000	4.592	34.5	225	1 STANDARD	50.700	49.738	0.737	50.710	49.605	0.880
4.000	11.949	99.6	150	1 STANDARD	50.707	49.800	0.757	50.710	49.680	0.880
1.003	16.170	78.1	225	1 STANDARD	50.710	49.605	0.880	50.645	49.398	1.022
1.004	43.097	165.1	300	1 STANDARD	50.645	49.398	0.947	51.077	49.137	1.640
5.000	23.696	44.0	225	1 STANDARD	50.845	49.750	0.870	51.077	49.212	1.640
1.005	3.915	244.7	300	1 STANDARD	51.077	49.137	1.640	51.260	49.121	1.839

Link	US Node	Dia (mm)	Width (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	PP1	450	450	Manhole	1 STANDARD	S1	1200	Manhole	1 STANDARD
2.000	PP2	450	450	Manhole	1 STANDARD	S1	1200	Manhole	1 STANDARD
1.001	S1	1200		Manhole	1 STANDARD	S2	1200	Manhole	1 STANDARD
1.002	S2	1200		Manhole	1 STANDARD	S3	1200	Manhole	1 STANDARD
3.000	EXSW-S1	1200		Manhole	1 STANDARD	S3	1200	Manhole	1 STANDARD
4.000	PP3	450	450	Manhole	1 STANDARD	S3	1200	Manhole	1 STANDARD
1.003	S3	1200		Manhole	1 STANDARD	EXSW-S2	1200	Manhole	1 STANDARD
1.004	EXSW-S2	1200		Manhole	1 STANDARD	EXSW-FC01	1200	Manhole	1 STANDARD
5.000	EXSW-S3	1200		Manhole	1 STANDARD	EXSW-FC01	1200	Manhole	1 STANDARD
1.005	EXSW-FC01	1200		Manhole	1 STANDARD	TWSW-2851	1200	Manhole	1 STANDARD

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections		Link	IL (m)	Dia (mm)
PP1	480350.245	167832.507	51.000	1.000	450	450		0	1.000	50.000	150
PP2	480353.742	167819.623	51.300	1.000	450	450		0	2.000	50.300	150
S1	480351.952	167825.278	51.300	1.455	1200			1 2 0	2.000 1.000 1.001	49.920 49.920 49.845	150 150 225
S2	480338.576	167821.368	51.300	1.540	1200			1 0	1.001 1.002	49.760 49.760	225 225
EXSW-S1	480323.319	167842.181	50.700	0.962	1200			0	3.000	49.738	225
PP3	480331.044	167833.925	50.707	0.907	450	450		0	4.000	49.800	150

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections		Link	IL (m)	Dia (mm)
S3	480320.157	167838.850	50.710	1.105	1200			1	4.000	49.680	150
								2	3.000	49.605	225
								3	1.002	49.605	225
								0	1.003	49.605	225
EXSW-S2	480308.992	167827.153	50.645	1.247	1200			1	1.003	49.398	225
								0	1.004	49.398	300
EXSW-S3	480294.769	167874.223	50.845	1.095	1200			0	5.000	49.750	225
EXSW-FC01	480278.188	167857.294	51.077	1.940	1200			1	5.000	49.212	225
								2	1.004	49.137	300
								0	1.005	49.137	300
TWSW-2851	480275.424	167860.067	51.260	2.139	1200			1	1.005	49.121	300

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

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	40	0	0

Node EXSW-FC01 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	49.137	Product Number	CTL-SHE-0058-1800-1500-1800
Design Depth (m)	1.500	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.8	Min Node Diameter (mm)	1200

Node PP1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	50.550	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.300
Safety Factor	2.0	Width (m)	4.800	Inf Depth (m)	
Porosity	0.30	Length (m)	13.000		

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Node PP2 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	50.850	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.300
Safety Factor	2.0	Width (m)	4.800	Inf Depth (m)	
Porosity	0.30	Length (m)	12.000		

Node S2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	49.760
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	66.0	66.0	0.800	66.0	92.0	0.801	0.0	92.0

Node EXSW-S3 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	50.395	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.200
Safety Factor	2.0	Width (m)	20.000	Inf Depth (m)	
Porosity	0.30	Length (m)	12.000		

Node EXSW-FC01 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	49.137
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	90.0	90.0	0.750	90.0	118.5	0.751	0.0	118.5

Node PP3 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	50.255	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.400
Safety Factor	2.0	Width (m)	30.000	Inf Depth (m)	
Porosity	0.30	Length (m)	30.000		

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Results for 1 year Critical Storm Duration. Lowest mass balance: 98.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	PP1	10	50.040	0.040	2.7	0.0235	0.0000	OK
15 minute winter	PP2	10	50.339	0.039	5.9	0.0405	0.0000	OK
15 minute winter	S1	10	49.918	0.073	8.5	0.0821	0.0000	OK
15 minute winter	S2	13	49.853	0.093	24.2	6.0459	0.0000	OK
15 minute winter	EXSW-S1	10	49.767	0.029	3.2	0.0469	0.0000	OK
15 minute winter	PP3	10	49.838	0.038	2.4	0.0219	0.0000	OK
15 minute winter	S3	13	49.692	0.087	17.1	0.0981	0.0000	OK
480 minute winter	EXSW-S2	408	49.572	0.174	4.0	0.2605	0.0000	OK
15 minute winter	EXSW-S3	10	49.796	0.046	7.2	0.0957	0.0000	OK
480 minute winter	EXSW-FC01	408	49.572	0.435	5.8	37.8812	0.0000	SURCHARGED
120 minute winter	TWSW-2851	78	49.148	0.027	1.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	PP1	1.000	S1	2.6	0.721	0.144	0.0273	
15 minute winter	PP2	2.000	S1	5.9	1.695	0.130	0.0205	
15 minute winter	S1	1.001	S2	8.4	0.921	0.208	0.1669	
15 minute winter	S2	1.002	S3	13.5	0.935	0.335	0.3744	
15 minute winter	EXSW-S1	3.000	S3	3.2	0.597	0.036	0.0378	
15 minute winter	PP3	4.000	S3	2.4	0.689	0.133	0.0410	
15 minute winter	S3	1.003	EXSW-S2	17.3	1.132	0.293	0.2476	
480 minute winter	EXSW-S2	1.004	EXSW-FC01	4.0	0.426	0.046	2.4280	
15 minute winter	EXSW-S3	5.000	EXSW-FC01	7.1	1.217	0.090	0.2546	
480 minute winter	EXSW-FC01	1.005	TWSW-2851	1.4	0.400	0.019	0.0134	46.3

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Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 98.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute winter	PP1	585	50.412	0.412	0.8	0.2400	0.0000	SURCHARGED
600 minute winter	PP2	585	50.412	0.112	1.8	0.1165	0.0000	OK
600 minute winter	S1	585	50.412	0.567	2.6	0.6409	0.0000	SURCHARGED
600 minute winter	S2	585	50.412	0.652	11.1	42.5433	0.0000	SURCHARGED
600 minute winter	EXSW-S1	585	50.412	0.674	1.0	1.0839	0.0000	FLOOD RISK
600 minute winter	PP3	585	50.412	0.612	7.6	38.5817	0.0000	FLOOD RISK
600 minute winter	S3	585	50.412	0.807	8.1	0.9123	0.0000	FLOOD RISK
600 minute winter	EXSW-S2	585	50.411	1.013	8.4	1.5201	0.0000	FLOOD RISK
600 minute winter	EXSW-S3	585	50.411	0.661	2.2	2.1082	0.0000	SURCHARGED
600 minute winter	EXSW-FC01	585	50.411	1.274	12.1	66.2793	0.0000	SURCHARGED
600 minute winter	TWSW-2851	585	49.151	0.030	1.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
600 minute winter	PP1	1.000	S1	0.8	0.516	0.043	0.1308	
600 minute winter	PP2	2.000	S1	1.8	1.223	0.040	0.0939	
600 minute winter	S1	1.001	S2	2.6	0.414	0.064	0.5542	
600 minute winter	S2	1.002	S3	6.8	0.736	0.168	1.0100	
600 minute winter	EXSW-S1	3.000	S3	0.9	0.226	0.010	0.1826	
600 minute winter	PP3	4.000	S3	-7.0	0.464	-0.393	0.2104	
600 minute winter	S3	1.003	EXSW-S2	7.5	0.781	0.127	0.6431	
600 minute winter	EXSW-S2	1.004	EXSW-FC01	8.2	0.495	0.095	3.0349	
600 minute winter	EXSW-S3	5.000	EXSW-FC01	1.9	0.517	0.024	0.9424	
600 minute winter	EXSW-FC01	1.005	TWSW-2851	1.7	0.425	0.023	0.0152	68.4

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Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 98.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute winter	PP1	705	50.573	0.573	0.9	0.6381	0.0000	SURCHARGED
720 minute winter	PP2	705	50.573	0.273	2.1	0.2844	0.0000	SURCHARGED
720 minute winter	S1	705	50.573	0.728	2.9	0.8230	0.0000	SURCHARGED
720 minute winter	S2	705	50.573	0.813	12.4	52.2930	0.0000	SURCHARGED
720 minute winter	EXSW-S1	705	50.573	0.835	1.1	1.3433	0.0000	FLOOD RISK
720 minute winter	PP3	705	50.573	0.773	11.2	82.1798	0.0000	FLOOD RISK
720 minute winter	S3	705	50.573	0.968	10.4	1.0942	0.0000	FLOOD RISK
720 minute winter	EXSW-S2	705	50.573	1.175	7.6	1.7618	0.0000	FLOOD RISK
720 minute winter	EXSW-S3	705	50.572	0.822	2.5	14.0425	0.0000	FLOOD RISK
720 minute winter	EXSW-FC01	705	50.572	1.435	11.3	66.5463	0.0000	SURCHARGED
720 minute winter	TWSW-2851	705	49.152	0.031	1.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
720 minute winter	PP1	1.000	S1	0.9	0.515	0.047	0.1308	
720 minute winter	PP2	2.000	S1	2.1	1.203	0.046	0.1044	
720 minute winter	S1	1.001	S2	2.8	0.414	0.069	0.5542	
720 minute winter	S2	1.002	S3	6.2	0.715	0.153	1.0100	
720 minute winter	EXSW-S1	3.000	S3	1.0	0.224	0.012	0.1826	
720 minute winter	PP3	4.000	S3	-10.4	-0.588	-0.582	0.2104	
720 minute winter	S3	1.003	EXSW-S2	6.7	0.743	0.114	0.6431	
720 minute winter	EXSW-S2	1.004	EXSW-FC01	7.5	0.488	0.087	3.0349	
720 minute winter	EXSW-S3	5.000	EXSW-FC01	2.4	0.517	0.030	0.9424	
720 minute winter	EXSW-FC01	1.005	TWSW-2851	1.7	0.433	0.025	0.0158	83.3

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