RIDGE

BICESTER MOTION
THE EXPERIENCE QUARTER

FLOOD RISK AND DRAINAGE ASSESSMENT

03 December 2021

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THE EXPERIENCE QUARTER

FLOOD RISK AND DRAINAGE ASSESSMENT

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Prepared for

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CONTENTS

1. SUMMARY

Ridge and Partners LLP have been commissioned to prepare a Flood Risk and Drainage Assessment in support of the Bicester Motion Experience Quarter development at the former RAF Bicester site, Buckingham Road, Bicester, Oxfordshire, OX27 8AL.

This report has been prepared to provide a Flood Risk and drainage overview for an outline planning application with the Local Planning Authority (LPA), Cherwell District Council (CDC) for the proposed Experience Quarter development at the former RAF site. The report has been updated to address the comments raised by Sujeenthan Jeevarangan, the Lead Local Flood Authority's planning engineer, provided in May 2021.

The site is located within Flood Zone 1 as defined in the NPPF and has not been identified as being at risk of flooding associated with fluvial, pluvial, tidal, sewers or groundwater. As the site is located within Flood Zone 1, the Sequential Test was passed and there is no requirement to apply the Exception Test.

Proposals for the surface water drainage require the use of Sustainable Urban Drainage Systems (SuDS) as these will not only manage surface water run-off but also offer benefits in pollution prevention creating and sustaining better places for people and nature.

There are known capacity constraints in Thames Water's foul sewer network therefore discussions will be required with Thames Water via a predevelopment enquiry to establish how additional capacity can be provided to accommodate the development.

It is proposed to drain the foul sewage from the site to the public foul sewer network in Buckingham Road.

2. INTRODUCTION

Ridge and Partners LLP have been commissioned to prepare a Flood Risk and Drainage Assessment in support of the Bicester Motion Experience Quarter development at the former RAF Bicester site, Buckingham Road, Bicester, Oxfordshire, OX27 8AL.

This report has been prepared to provide a Flood Risk and drainage overview for an outline planning application with the Local Planning Authority (LPA), Cherwell District Council (CDC) for the proposed Experience Quarter development at the former RAF site.

The National Planning Policy Framework (NPPF) states that a site-specific Flood Risk Assessment (FRA) is required in the following circumstances:

- 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 LPA 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.

This site falls within the Flood Zone 1 and is greater than 1ha in size. Therefore, a Site-Specific FRA is required to ensure the development is safe from flooding and will not increase the risk of flooding elsewhere.

This FRA assesses the flood risk of the existing site whilst setting out the parameters for the drainage design of the future development to minimise flood risk on the site and the neighbouring properties. It not only considers the risk of fluvial flooding on the development, but also the risk of flooding from the non-fluvial sources, including overland flows, groundwater, sewer flooding and flooding from artificial sources.

The report includes a review of the existing foul flows and identifies the need for a Pre-development Enquiry with Thames Water to establish the likely capacity constraints and identify any off-site improvements that may be required to accommodate the development.

3. SITE DESCRIPTION

3.1. Site Location

Site Name: Bicester Motion at the former RAF Bicester site
Site Address : Buckingham Road, Bicester, Oxfordshire, OX27 8AL
Site National Grid Reference: Eastings: 459859, Northings: 224563

The site lies to the north of Bicester town centre within the boundary of the former RAF Bicester Site. Buildings in the south west corner of the site are currently occupied by Bicester Heritage and the existing hangars occupied by the Bicester Gliding Club. Scattered around the site are a number of listed defence structures and to the east of the site there are a number of bomb stores. The airfield taxiway is located to the east of the existing buildings and west of the bomb stores.

The site is bounded by Buckingham Road (A4421) to the west, Skimmingdish Lane to the south and Bicester Road (road to Stratton Audley) to the North. The south east corner of the site is bounded by the newly constructed Bakels factory and to the north east, the site is bounded by agricultural land. The site benefits from three vehicular entrances, two from the A4421 Buckingham Road and one from Skimmingdish Lane.

The wider surrounding area is characterised by residential, commercial, agricultural land and associated road networks as illustrated below in Figure 1.

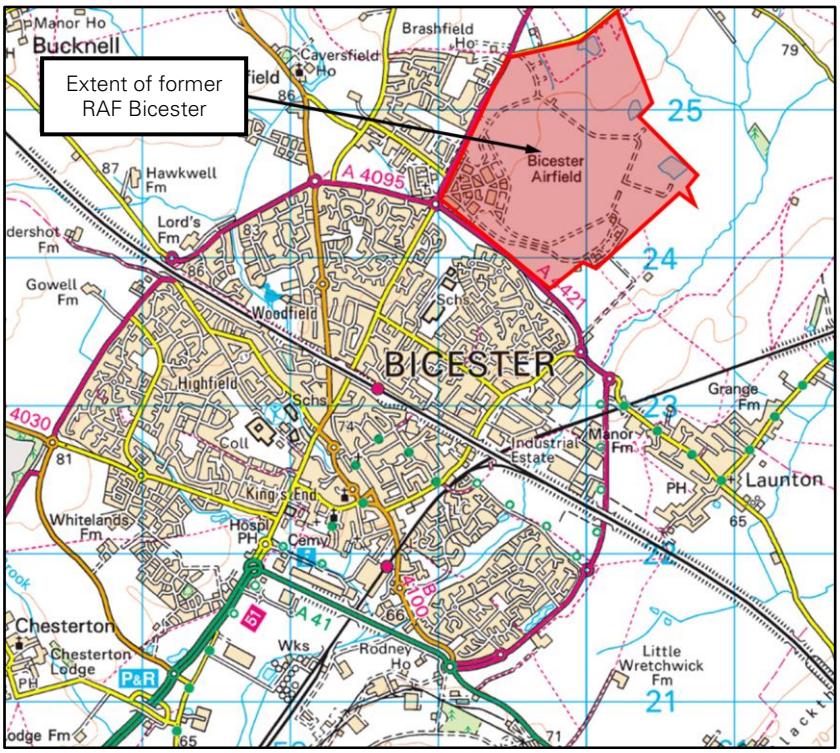


Figure 1 – Site Location

3.2. Land Use and Topography

The existing site is relatively level with ground levels sloping from 83.0m above ordnance datum (mAOD) along the western side of the site to 73.0mAOD along the eastern boundary. This equates to an average gradient across the site of approximately 1:100.

The former RAF site is approximately 1.3km wide and 1.3km in length. The approximate area of the site is 171 hectares.

Appendix A shows the topographic survey and the existing site layout.

3.3. Hydrology

The closest main river to the site is Langford Brook, which is located approximately 500m to the east of the site and is designated as Main River by the EA. This watercourse flows north to south before it joins the River Ray approximately 7.5km downstream of the site to the south.

The closest watercourse is located to the north of the site. The watercourse runs from north to south towards the centre of the site. It is currently unclear on the route the watercourse takes through the site but the topography of the site suggests the watercourse drains to the east. Further investigation is required.

The nearest standing water body is located within the site. There are three lakes adjacent to the north east boundary of the site which are former quarry pits that have been filed with water.

There are no canals within the proximity of the proposed development.

3.4. Geology

Based on published geological records for the area (British Geological Survey online mapping), the site is underlain by Jurassic bedrock of the Cornbrash Formation, overlying the Forest Marble Formation. No significant superficial deposits are recorded locally. Refer to Figure 2 below:

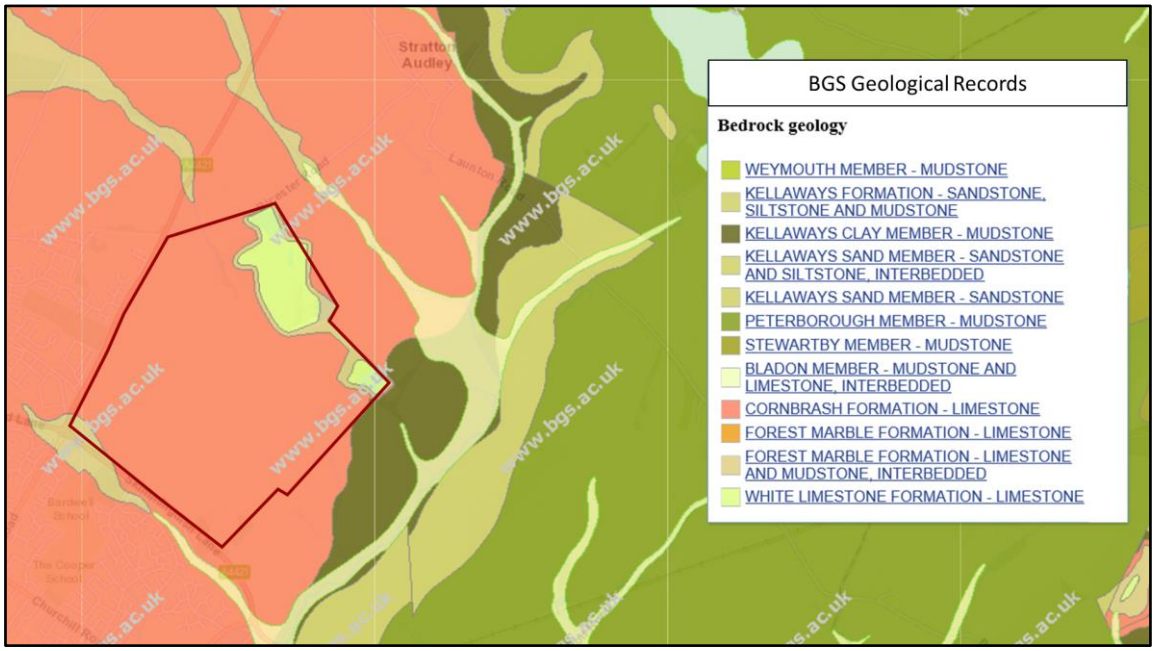


Figure 2 – British Geological Survey Records for North east Bicester (sourced from BGS website 01/02/2019)

Reference to BGS borehole scan SP52SE174, enclosed in Appendix B, located in the south east corner of the site, confirms the presence of the Cornbrash Formation layer approx. 9ft deep, Forest Marble formation layer approximately 10ft deep and white limestone layer approximately 38ft deep. The borehole also indicates that groundwater was encountered which varied during the time of year from 3ft to 12ft deep below ground level (mBGL).

Percolation tests were undertaken across the site in June 2021 to address the concerns set out in the Lead Local Flood Authority's report dated 14/5/21. The location and depths of the percolation tests are shown on the drainage strategy plan enclosed in Appendix D and the results of the percolation tests are enclosed in Appendix F. A summary of the results is outlined below:

TP01 – 1.63x10^{-3} m/s
TP02 – Not undertaken
TP03 – 1.42x10^{-5} m/s
TP04 – Unable to complete due to high groundwater.

The results indicate that soakage is available across the site accept where the ground water was encountered.

A series of site investigations have already been undertaken to inform the design of other developments across the Bicester Motion site. These include the Command Works and the Innovation Quarter where a full investigation was undertaken and infiltration tests in the vicinity of the hotel. Outlined below is a summary of the results together with a plan showing the location of these developments.

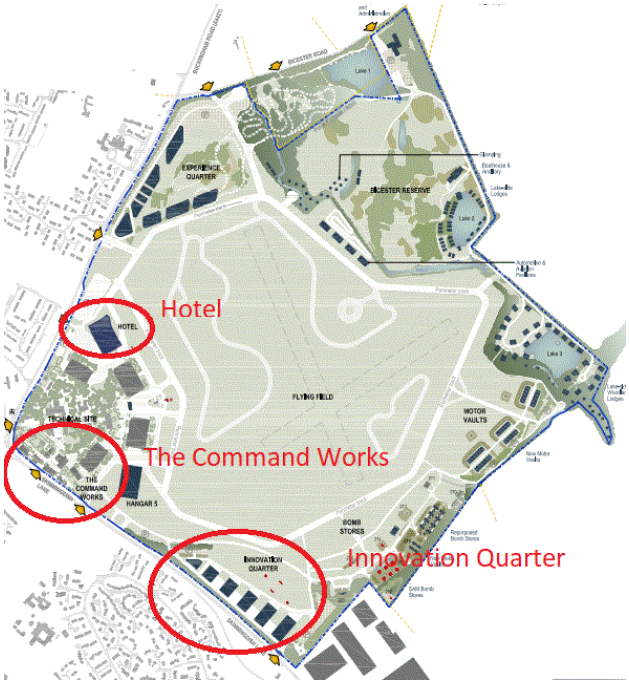


Figure 3 – Development location plan on the Bicester Motion site

The Command Works - The exploratory field work identified that the site is generally underlain by thin Topsoil (down to a maximum depth of 0.40m bgl), overlying localised Made Ground (encountered down to a maximum depth of 0.40m bgl), overlying a weathered Cornbrash Formation (down to a maximum depth of 1.0m bgl) becoming unweathered Cornbrash Formation. Rock quality strata was then proven down to 1.60m and 2.0m bgl across the site. However, no Forest Marble Formation soils were encountered. Monitoring of the groundwater level was carried out between September 2018 and January 2019 which recorded the groundwater level between 1.1 and 1.71m below ground level. A supplementary sampling exercise was carried out in August 2019 which indicated groundwater levels of between 1.4m and 2.02m below ground level. Furthermore, the composition of the underlying groundwater was deemed to be consistent of that with uncontaminated groundwater. Three infiltration tests were carried out in accordance with the BRE365 standard with infiltration rates of between 1.02x10^{-4} m/s to 9.78x10^{-5} m/s within the Cornbrash Formation being achieved.

Innovation Quarter – The site investigation was undertaken in May 2021. A series of trial pits and boreholes were carried out across the site which identified topsoil/ made ground overlying silty clay and then Cornbrash gravel. Six percolation tests up to 2.5m deep were undertaken in accordance with BRE Digest 365 and these identified soakage potential in three of trial holes that ranged from 1.64 x 10^{-5} m/s to 7.75 x 10^{-5} m/s. The remaining trial pits resulted in an invalid test due to a limited drop in water level after 6 hours. Ground water

monitoring was undertaken between May and June and the average water depth was between 1.08m and 1.45m below ground level.

Hotel - The drainage strategy, prepared by AKS ward, in support of the planning application for the Bicester Heritage Hotel, references two soakaway tests in accordance with BRE365 Digest. These tests were recorded approximately 300m south of the proposed Experience Quarter buildings. The results of the tests report a soil infiltration rate of between 1.43x10-6m/s and 1.81x10-6m/s at a depth of 1 metre.

Upon gaining outline planning approval, a detailed site-specific geotechnical investigation shall be carried out to determine the soil properties of the site. The site investigation will include but not be limited to the following:

- Infiltration testing to BRE 365 Digest.
- Groundwater monitoring over the winter period.
- Soil testing and assessment on locations of contaminations.

3.5. Hydrogeology

According to the MAGiC database which reference Environment Agency records on Aquifer Designations, the majority of the site falls within a Secondary A bedrock aquifer and a small area towards the north east boundary of the site is designated as a Principal bedrock aquifer. No superficial aquifers fall within the vicinity of the site. In addition, there are no Groundwater Source Protection Zones within the site vicinity. An extract from the MAGiC database is shown below in Figure 4.

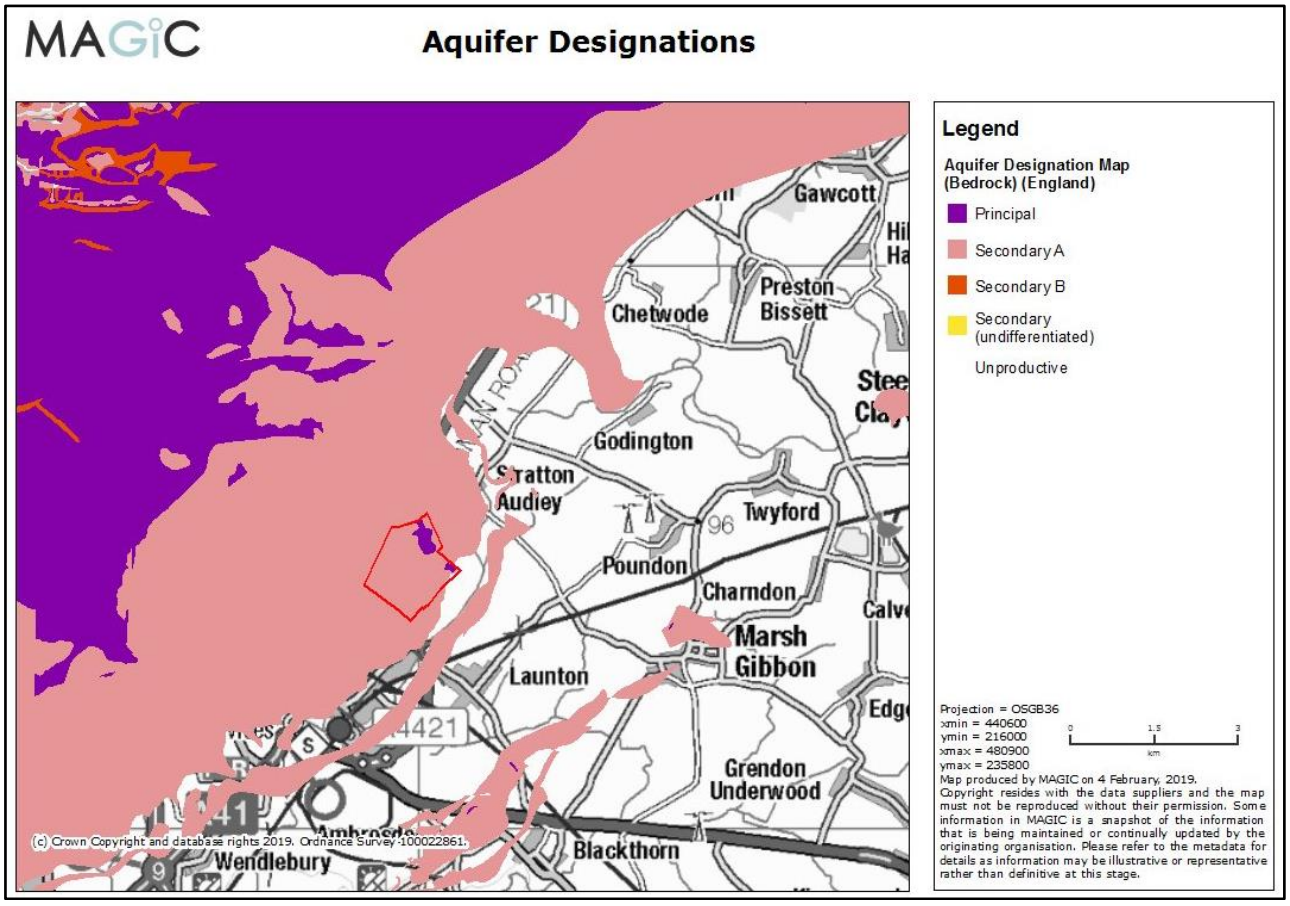


Figure 4 – Aquifer Designations (sourced from MAGiC database 04/02/2019)

3.6. Existing Drainage

Public sewer

Sewer details have been referenced from Thames Water sewer records, found in Appendix C.

Foul water

The sewer records indicate that there is a 225mm diameter foul water sewer that runs along the westerly edge of the site and then cuts across the south west corner of the site. The sewer flows from north to south.

A 450mm diameter foul water sewer is located beneath the A4421 Buckingham Road to the west of the site. This sewer runs from north to south and continues to run along the Buckingham Road towards Bicester Town.

It is understood that the sewer drains to the sewage treatment works located to the south of Bicester Town, adjacent to the Tesco Superstore.

It is apparent, based on our knowledge from the Command Works development that the Thames Water's foul sewer network in Bicester has limited capacity for future development and therefore further discussions with Thames Water Development Team will be required through the Pre-development Enquiry application process to establish how the additional capacity can be provided.

Surface water

The sewer records do not indicate any surface water sewers within the vicinity of the site.

Private drainage

There are a number of internal foul and surface water drains that serve the former Bicester RAF site. Typically, the surface water within the site is managed using soakaways.

The network of internal foul drains connects to the foul sewers within the site.

3.7. Other Site constraints

According to the MAGiC database the site is home to a number of grade 2 listed buildings and scheduled monuments. In addition to this, there are two areas on the site that are designated as a Site of Special Scientific Interest (SSSI) which are the Stratton Audley Quarries 1 and 2. The SSSI sites are classified as destroyed which mean that lasting damage has occurred to the designated feature such that the feature has been irretrievably lost (no amount of management will bring this feature back). An Extract from the MAGiC database can be seen below in Figure 5.

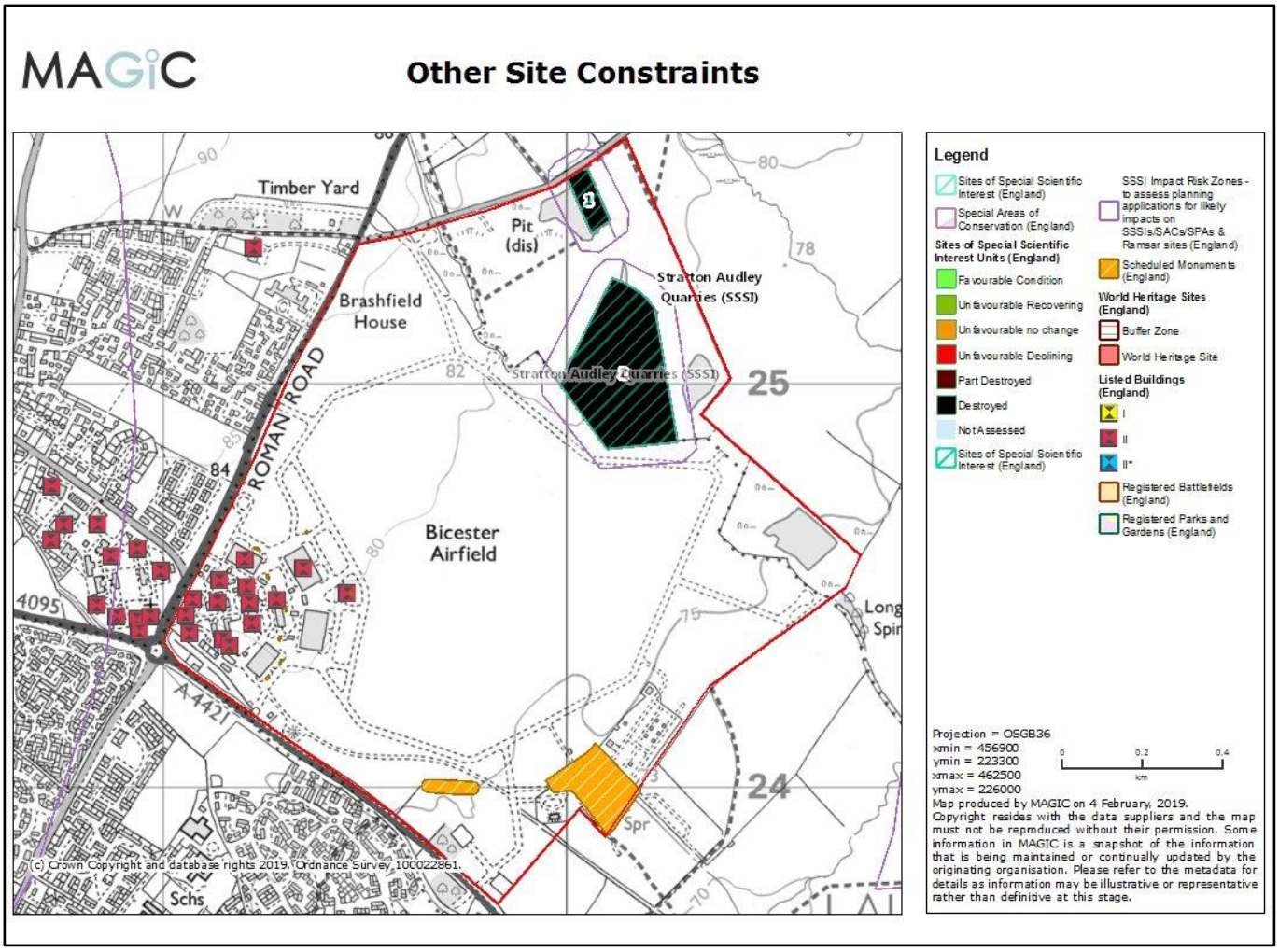


Figure 5 – Other Site Constraints (sourced from MAGiC database 04/02/2019)

4. DEVELOPMENT PROPOSALS

The proposed Bicester Motion Narrative is as follows:

The Experience Quarter

The Experience Quarter will be formed as a cluster of high-quality buildings that will house world-leading brands across the Motion sector with each building providing views across the airfield, towards the vibrant activities taking place in the air and on the tracks, visitors can enjoy wings and wheels technology.

New driver training and handling tracks will be formed for visitors to learn new skills in a safe and family focused environment, guests of all ages can get behind the wheel or simply enjoy the show from the viewing points and walkways planned.

Demonstration and event areas are planned enabling brands to showcase new and exciting technologies to the public. As we move towards a greener future we aspire that the Experience Quarter will be internationally recognised as the leading site for sustainable transport product launch and demonstrations with the benefit of the on-road and off-road tracks, demonstration zones and airfield.

The creation of new walkways and cycleways connecting the four Quarters of the site (Heritage, Innovation, Wilderness & Experience) will enable visitors to explore on foot, cycle, scooters or shuttle promoting health and well-being through the enjoyment of open green space filled with vibrant activities for all of the family.

The Airfield

The airfield operated by the Bicester Aerodrome company (a wholly owned subsidiary of Bicester Motion) will host a wide range of aviators who will demonstrate and promote aviation's past present and future bringing the history of the site to life.

5. SOURCES OF FLOOD RISK

5.1. Flooding from rivers (fluvial flood risk)

The Environment Agency online Flood Map identifies the site outside the 0.1% Annual Exceedance Probability (AEP) flood extent associated with the Langford Brook. Refer to Figure 6 below. To the east of the site, the adjacent land is situated within an area of Flood Zone 2. The Flood Zone 2 does not fall within the site extents.

Furthermore, site contours from the topographical survey show that the site is approximately 3-10m above the Langford Brook level which was obtained from the Ordnance Survey contours for the brook. This natural topography provides protection to the former RAF site as the majority of Bicester and surrounding land would flood before the proposed development site.

On the basis of these findings, it can be determined the site is not at risk of fluvial flooding.

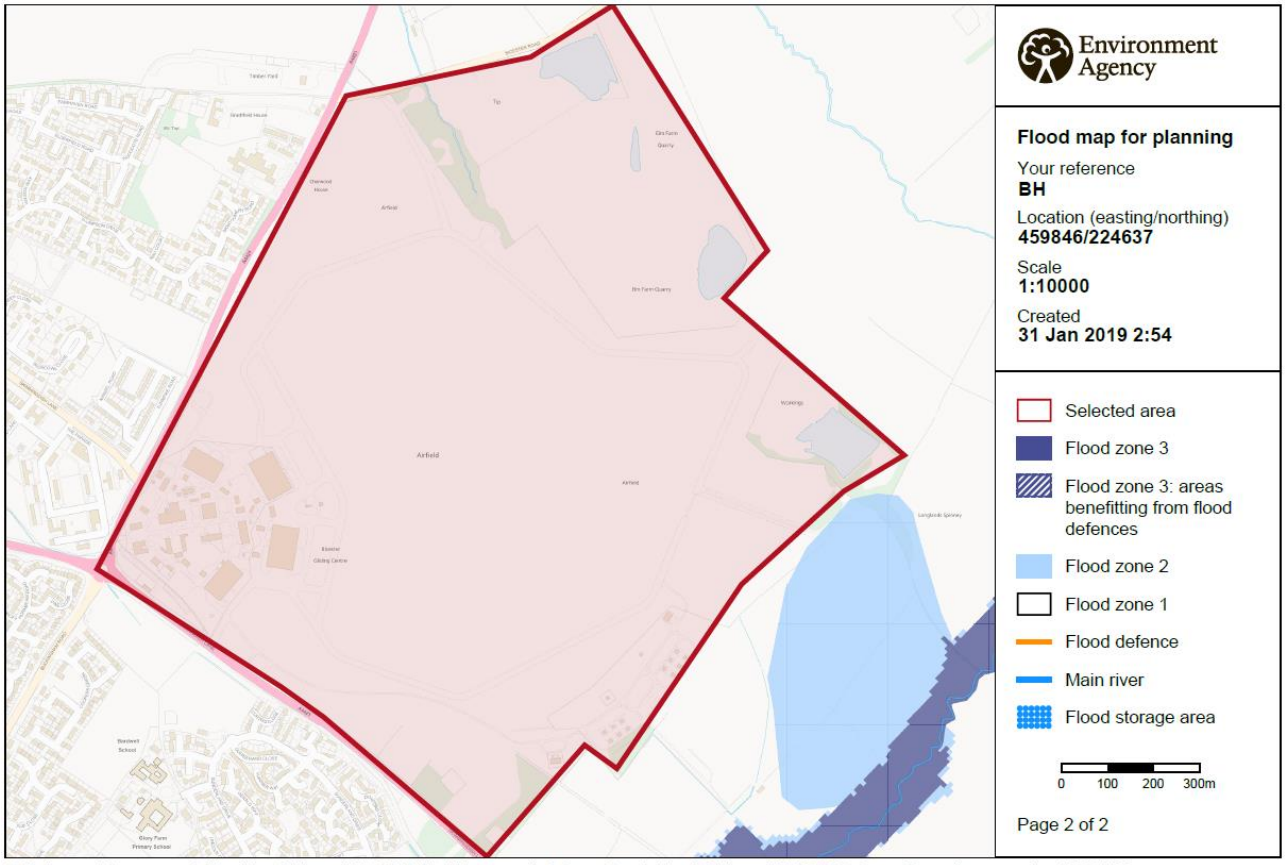


Figure 6 – Fluvial Flood Risk (sourced from EA website 31/01/2019)

5.2. Flooding from the sea (tidal flood risk)

The site is a considerable distance from the sea and therefore is not currently identified at risk of coastal or tidal flooding.

5.3. Flooding from the land (overland pluvial flood risk)

In the event of intense rainfall and when the infiltration capacity of the land has been exceeded, rainwater will flow overland. This rainwater will collect in depressions of the topography and at obstructions, which can inundate development in low lying areas.

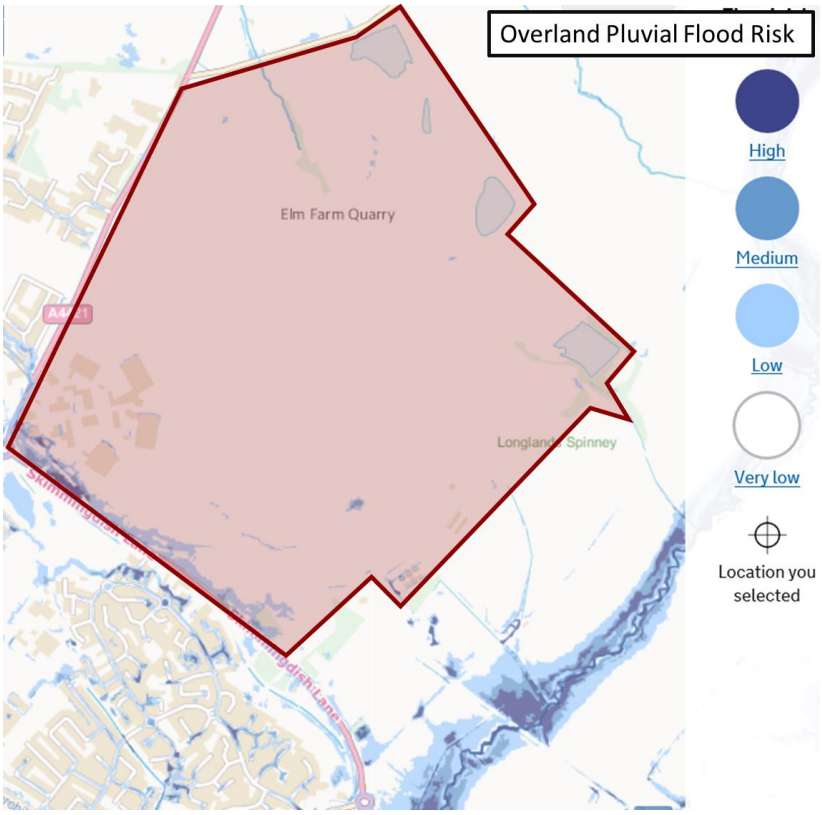


Figure 7 – Overland Pluvial Flood Risk (sourced from EA website 31/01/2019)

The Environment Agency Flood Maps for Surface Water (as shown in Figure 7) show the approximate areas that could experience surface water flooding from a range of AEP's, which is used to categorise the risk. The surface water maps identify that there is a very low risk of surface water flooding (<0.1% AEP) for the majority of the airfield. The northern side of Skimmingdish Lane, however, has been identified as medium to high risk, part of which falls within the boundary of the proposed Command Works development. These overland pluvial flood flows are managed on the site site through the use of an attenuation basin and a conveyance swale.

5.4. Flooding from groundwater

According to the Cherwell District Council Strategic Flood Risk Assessment (SFRA) (2017) Plan B8, the northeast quadrant of Bicester, which includes the site and surrounding area, is not considered at risk from groundwater flooding. The site is located within the wider slope of the valley, and as such any emerging groundwater would flow under gravity to the east, resulting in minimal flood levels if groundwater did emerge.

Monitoring of the groundwater level was carried out for The Command Works development between September 2018 and January 2019. The results of which recorded the groundwater level between 1.1 and 1.71m below ground level. Monitoring on the Innovation Quarter site recorded average groundwater depths of between 1.08m and 1.45m below ground level during May and June 2021.

On the basis of these findings, the risk of groundwater flooding is understood to be low.

5.5. Flooding from sewers

According to the Cherwell SFRA Plan B-10, the site has had 0-5 sewer flooding incidents due to failure or capacity issues. Therefore, the site is deemed to be at low risk of sewer flooding.

5.6. Flooding from Artificial Sources

The site is not identified as being at risk of reservoir flooding from the Environment Agency Reservoir Flood Map as shown in Figure 8. The site is located a considerable distance from any canal and therefore not at risk from flooding from this source.

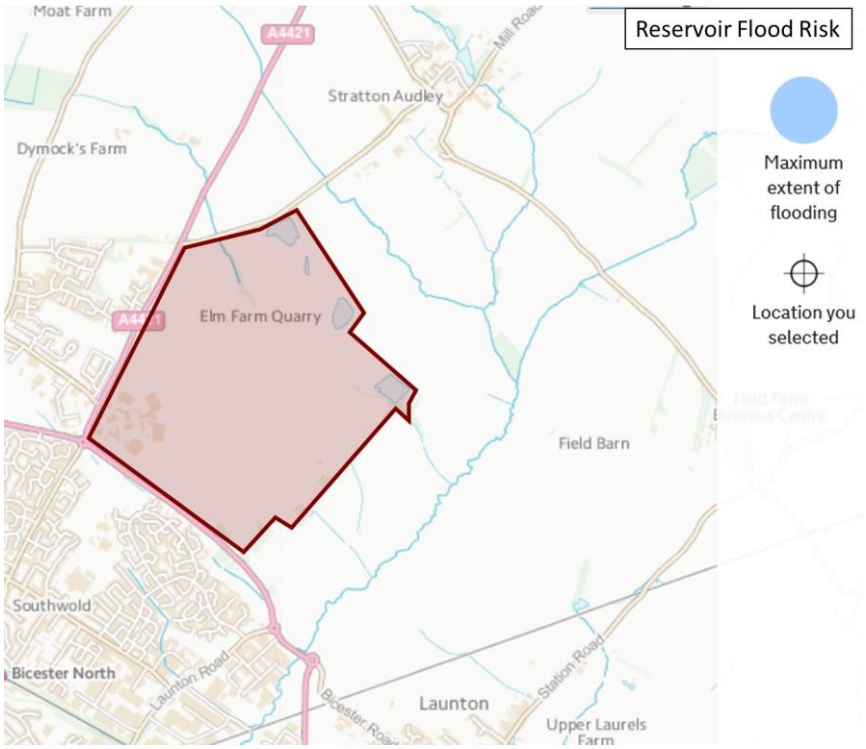


Figure 8 – Reservoir Flood Risk (sourced from EA website 31/01/2019)

5.7. Flooding History

No historic flooding has been recorded within the Cherwell SFRA for the site or surrounding area of north east Bicester. Flooding has been limited to the southern reaches of the Langford Brook floodplain within Bicester which is located over 500m east of the site, and roughly 3m lower than the lowest site levels.

5.8. Sequential Test

The NPPF follows a sequential risk-based approach in determining the suitability of land for development in flood risk areas, with the intention of directing development to areas at little or no risk of flooding from any source in preference to areas at higher risk. NPPF Table 2 confirms the 'Flood risk vulnerability classification' of a site, depending upon the proposed usage. This classification is subsequently applied to Table 3 'Flood risk vulnerability and flood zone compatibility' to determine whether:

- The development is suitable for the flood zone in which it is located; and
- Whether an Exception Test is required for the proposed development.

The proposed development has a mixture of 'less vulnerable' commercial uses and 'more vulnerable' accommodation/resort-based development.

As the entire site lies within Flood Zone 1, the Sequential Test is passed and there is no requirement to apply the Exception Test.

6. SURFACE WATER DRAINAGE PROPOSALS

The Experience Quarter development is designated as a major planning development. The NPPF sets out the requirement for all major development to include Sustainable Urban Drainage Systems (SuDS).

The SuDS systems aim to deal with rainwater where it falls (at source), allowing as much water as possible to either evaporate or soak into the ground. Remaining runoff is then drained to the nearest water body, ideally via other forms of SuDS, at the same rate and volume or lower as would naturally have occurred prior to development. During this process, SuDS reduce pollutants in the water, such as hydrocarbons, nutrients and heavy metals, by filtering and treating runoff. This ensures that the water soaking into the ground and discharging to nearby watercourses or sewers is cleaner, protecting water quality and wildlife.

Management of surface water run-off using SuDS is just one aspect of SuDS design. If managed appropriately, SuDS can offer real value to a development through enhancing green space which supports the provision of habitats and places for wildlife to live and flourish.

The use of SuDS is also highly encouraged by the Lead Local Flood Authority (LLFA). The SuDS applications proposed on this development is outlined in Table 1 below:

SUDS FEATURE	DESCRIPTION
Permeable Surfaces	Permeable surfaces allow rainwater to infiltrate through the surface into an underlying storage layer, where water is stored before infiltration to the ground, reuse, or release to surface water.
Filter Drains	Linear drains/trenches filled with a permeable material, often with perforated pipe in the base of the trench. Surface water from the edge of paved areas flows into the trenches, is filtered and conveyed to other parts of the site.
Ponds	Depressions used for storing and treating water.
Detention Basin	Dry depressions designed to store water for a specified retention time.
Swales	Shallow vegetated channels that convey and/or retain water and can permit infiltration when unlined.

Table 1 – Description of SuDS Features proposed

An outline drainage strategy has been prepared for the proposed Experience Quarter development which is presented in Appendix D and detailed below.

The outline drainage strategy has been prepared with the view of using SuDS systems as referenced above. As areas around the site are recorded to have infiltration rates generally greater than $1x10^{-5}$m/s (Refer to section 3.4), it is therefore proposed to use soakage systems to manage the run-off from the development. As limited soakage was identified in a few locations across the wider development it is proposed to undertake infiltration tests and groundwater monitoring upon approval of the outline application.

Experience Quarter Driver Training School – It is proposed to drain the buildings to the north of the development via a network of pipes, manholes and potentially swales to 2 no. infiltration basins with permeable surfaces proposed for the parking areas. The use of permeable paving will not only allow rainwater to be stored in the granular sub-base but also improves water quality by trapping heavy metals in low concentrations whilst allowing hydrocarbons to be broken down naturally in the sub-base.

Automotive/ Aviation Clubhouse - It is proposed to drain the buildings located along the north-eastern edge of the development via a network of pipes, manholes and potentially swales to an adjacent infiltration basin.

Track side drainage – It is proposed to drain the surface run-off to a filter drain on the low side of the track, which will allow infiltration into the ground. To prevent a significant quantity of surface water draining to the low point of the filter drain, impermeable membranes will be installed at suitable intervals to encourage infiltration at the higher areas of the track. At the low point of the track a shallow basis will be provided to capture any exceedance flows.

Design Requirements

The surface water drainage systems have been designed in accordance with the Local Standards and Guidance for Surface Water Drainage on Major Development in Oxfordshire (Oxfordshire County Council).

The peak surface water run-off rate from the proposed development for the 1in 1 year rainfall event and the 1 in 100-year rainfall event should never exceed the peak greenfield run-off rate for the same event

Attenuation or infiltration structures shall accommodate up to a 1in100-year plus 40% for climate change storm event and the upstream drainage networks will not flood in a 1:30 year return period, which includes the track side filter drains.

The layout of the development will be designed so that any surface run and exceedance overland flows caused by rainfall events that exceed the design capacity are directed away from sensitive areas and conveyed to SuDS systems. The exceedance routes are shown on the drainage strategy plan enclosed in Appendix D.

A copy of the hydraulic (Microdrainage) calculations for the infiltration basins, permeable parking areas and track side filter drains are enclosed in Appendix G.

Management and Maintenance Plan

Regular inspections and maintenance of the surface water drainage system is essential to ensure the effective operation of the drainage systems. As the development will remain in Bicester Motion's ownership a management company will be set up to maintain the SuDS systems in perpetuity on Bicester Motion's behalf.

Outlined below are details of the proposed maintenance regime, which is in accordance with the guidance provided in the SUDS manual, CIRIA publication C753.

Infiltration Basin

The proposed attenuation basins will require regular ongoing maintenance to ensure continuing operation to the design performance standards.

The basin should be inspected on a regular basis (typically monthly) and any build-up of litter (including leaf litter in the autumn), debris and trash should be removed as required.

Routine maintenance of the landscaped areas, including grass cutting and the aquatic vegetation will also be required on a regular basis particularly during the growing season. Slope areas that have become bare should be re-vegetated and any eroded areas should be regraded before replanting.

Silt removal should be undertaken, as required, to ensure the effective operation of the basin and to maintain aesthetic appearance of the site. Care should be taken to avoid disturbance to nesting birds during the breeding season and habitats of target species at critical times. The window for carrying out maintenance to achieve this is usually towards the end of the growing season (typically September/ October). Invasive silt and

vegetation removal should only be carried out to limited areas at a time (25/ 30% of the basin on one occasion each year) to minimise the impact on biodiversity.

A summary of the maintenance requirements are provided in the schedule below:

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly
	Cut grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually (as set out in Chapter 23)
Occasional maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

Overland Flow Conveyance Features

Conveyance features installed within the site such as the Swales, depressions and ditches will be maintained and managed in perpetuity by the site owner. These features are required to ensure overland flows are conveyed to the infiltration basins.

Regular inspection and maintenance are required to ensure the conveyance features operate to their design performance standards.

Inspections will be required on a regular monthly basis which will require the removal of any litter or debris within the conveyance features. This shall include inspection to the culvert and any blockages or sediment removed.

The major maintenance requirement is to mow the grass of the conveyance features to achieve a grass length of between 75-150mm. This shall be carried out on a monthly basis through growing season. All grass clippings shall be removed from the extents of the swales.

Any sediment within the conveyance features shall be removed when it exceeds 25mm in depth.

A summary of the maintenance requirements are provided in the schedule below:

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly, or as required
	Cut grass – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours	Monthly, or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

Permeable Paving

The permeable paving should be inspected regularly, preferably during and after heavy rainfall, to check for effective operation and identify any areas of surface ponding.

Permeable paving should be regularly cleaned of silt and other sediment to preserve its infiltration capability.

Care should be taken to avoid stockpiling any materials, in particular granular material or soil, on the permeable paving to avoid contaminating the underlying granular sub-base and laying course. In the event of a spillage, vacuum sweeping of the affected area should be undertaking immediately.

A summary of the maintenance requirements is provided in the schedule below:

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 glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 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

Filter Drains

Filter drains require regular maintenance to ensure that they operate effectively throughout the lifetime of the development. The recommended maintenance regime is summarised in the table below.

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly (or as required)
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove sediment from pre-treatment devices	Six monthly, or as required
Occasional maintenance	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (eg NJUG, 2007 or BS 3998:2010)	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly, or as required
	Clear perforated pipework of blockages	As required

7. FOUL DRAINAGE PROPOSALS

7.1. Proposed Foul Network

The existing site has a network of private foul water drains in the southwest corner of the site which connect to the foul sewer. The Experience Quarter is mostly situated towards the north of the former RAF site and has no existing foul drainage infrastructure.

For the Experience Quarter, there is potential to connect to the gravity sewer that is located in Buckingham Road on the north-western boundary, although it is likely that a foul pumping station will be required.

An assessment of the potential foul flows from the development has been calculated as per the Table 3 below. As occupancy values for development are currently unknown, the Sewers for Adoption flow rates for use class have been used as a means of calculating the development flows.

DEVELOPMENT AREA	APPROX. FOOTPRINT (M^2)	NO. OF FLOORS	FLOOR AREA	DESIGN FLOW (L/S/HA)	TOTAL FLOW RATE (L/S)
Experience Quarter					
Single Storey	4,136	1	4,136	0.6	0.25
Two storeys	9,475	2	18,950	0.6	1.14
Trackside Pavilions	1,800	1	1,800	0.6	0.11
Total Foul Flow Rate for the Development	**15,411**		**24,886**		**1.5**

Table 3 – Estimated Foul Flow Rate

The total flow rate referenced in Table 3 above is based on a gravity connection to the mains sewer.

7.2. Limitations with the Existing Foul Network

A Pre-development Enquiry with Thames Water shall be requested to understand whether the sewer network has capacity whilst informing Thames Water of the proposed development so that their programme of network improvements consider this site.

8. CONCLUSION

This flood risk and drainage assessment report has been prepared in support of an outline planning application for the Bicester Motion Experience Quarter development at the former RAF Bicester Airfield, Bicester, OX26 5HA.

Based on the information available from the Environment Agency, Cherwell District Council, County Council (Lead Local Flood Authority) and MAGiC Database, the site, which is located in Flood Zone 1, as defined in the NPPF, is not identified as being at risk of flooding associated with fluvial, pluvial, tidal, sewers or groundwater. There is an overland pluvial flood risk within the south west part of the development but the proposed drainage strategy for the Command Works Site will manage the overland flows.

As the entire site lies within Flood Zone 1, the Sequential Test was passed and there is no requirement to apply the Exception Test.

Surface water runoff from the proposed development should be managed using Sustainable Urban Drainage Systems (SuDS) as these will not only manage surface water run-off, but also offer benefits in pollution prevention creating and sustaining better places for people and nature. SuDS systems identified to manage the surface water run-off from the Bicester Motion development have been detailed on the outline drainage strategy drawing provided in Appendix D. The underlying geology across the site comprises of Cornbrash formation and the soakage tests undertaken across the wider development indicate that the use of infiltration systems is an appropriate means of surface water disposal. Upon planning approval being granted, a comprehensive site investigation will be undertaken across the site that will include soakage tests to BRE Digest 365, groundwater monitoring and contamination testing to confirm the size of the infiltration systems.

The peak rate of surface water run-off from the development will not exceed the peak greenfield run-off rate from the existing site for the 1in1-year and 1in100-year rainfall events.

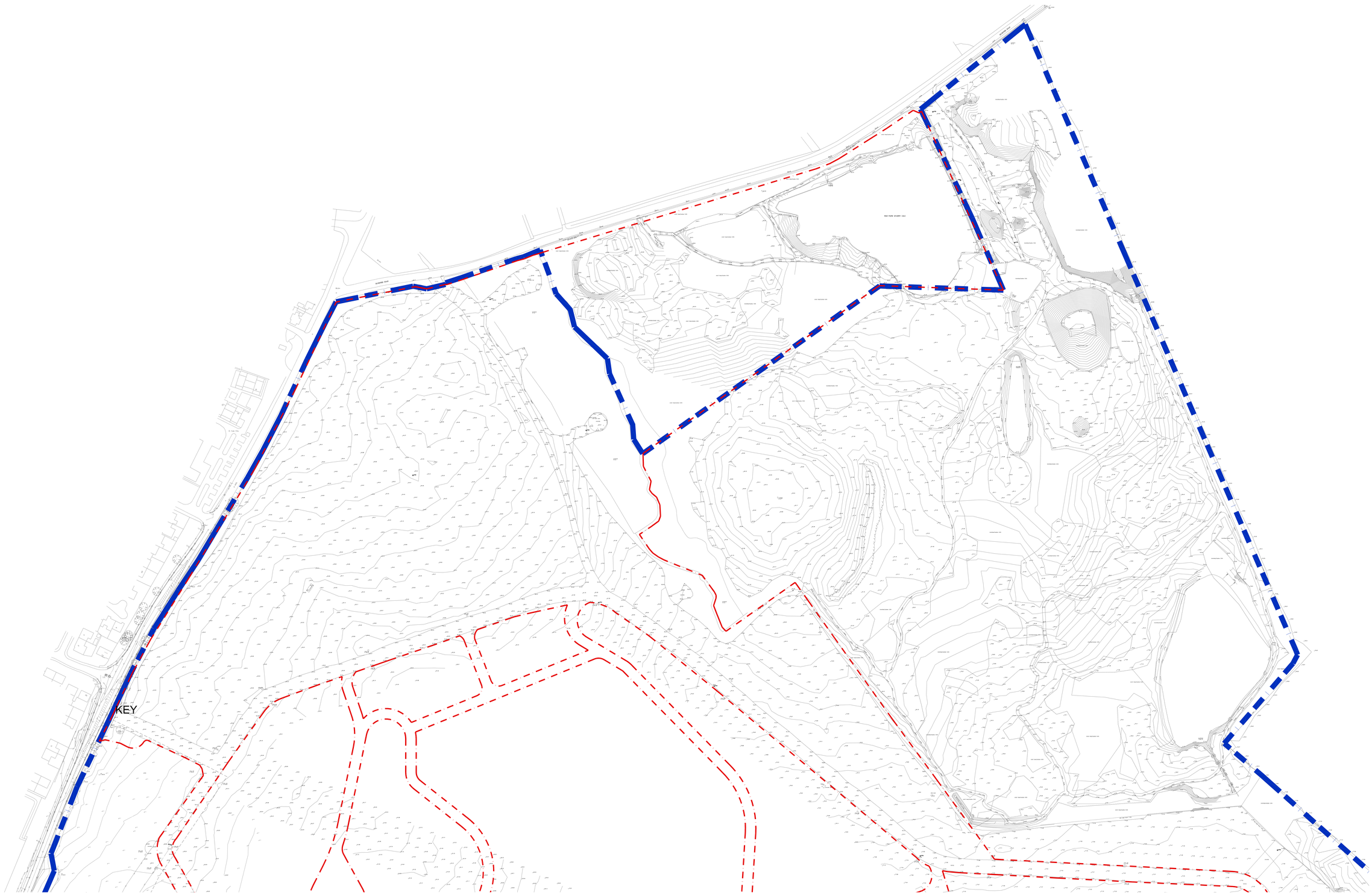
The infiltration systems will be designed to accommodate up to the 1in100-year return period plus climate change storm event with any surface run-off and overland flow caused by exceedance events being conveyed to the SuDS systems and contained on-site.

The existing foul sewer network is likely to have capacity issues; therefore, a pre-development enquiry will be carried out with Thames Water to establish how additional capacity can be provided to accommodate the development.

The majority of the development is located in areas where access to a foul sewer by gravity is limited. therefore, if a gravity connection is not feasible then a pumped system will be provided to serve the development.

The anticipated foul flow from the development is approximately 1.5l/s for a gravity connection.

APPENDIX A – TOPOGRAPHICAL SURVEY



KEY Application boundary Ownership boundary

10 0 10 20 30 40 50
SCALE 1:1250 m

N

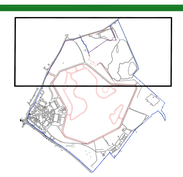
Experience Quarter Site Topographical Survey - Part 1

PLANNING

DRAWN BY: JY CHECKED BY: LS

5002854-RDG-Z01-ST-PL-A-0015 REV:- 20/11/2020

SCALE 1:1250 @ A0



NOTE:
Drawing based on information provided by On Centre Surveys Ltd:

- 25557C-1, November 2018
- 25557C-2, November 2018
- 25557C-5, November 2018
- 25557C-6, November 2018
- 25557C-10, November 2018

RIDGE

KEY

KEY Application boundary Ownership boundary

10 0 10 20 30 40 50
SCALE 1:1250 m

N

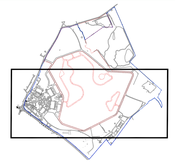
Experience Quarter Site Topographical Survey - Part 2

PLANNING

DRAWN BY: JY CHECKED BY: LS

5002854-RDG-Z01-ST-PL-A-0016 REV:- 20/11/2020

SCALE 1:1250 @ A0



NOTE:
Drawing based on information provided by On Centre Surveys Ltd:

- 25557C-1, November 2018
- 25557C-2, November 2018
- 25557C-5, November 2018
- 25557C-6, November 2018
- 25557C-10, November 2018

RIDGE

APPENDIX B – BGS BOREHOLE SCAN SP52SE174

At Bicester R.A.F. Station ~~site selected is 5910~~ SP 5910 2425

Town or Village Bicester County Oxon Six-inch quarter sheet

Exact site E. side of Roman Way, 1650 yds NE. of the railway (A ... or a tracing ... maps very ...)

in parish of SP 5910 2446

Level of ground surface above sea-level (O.D.) c240 ft. If well starts below ground surface, state how far

Shaft ft., diameter ft. Bore 140 ft. Diameter of bore: at top 15" ins.; at bottom 12"

Details of permanent lining tubes (internal diameters preferred) 30' × 15 in., from surface; then 12 in. to bottom, part perforated. (101'–120') See over page

Water struck at depths of (feet)

Rest-level of water ~~above~~ below top of well 3–12 * feet. Suction at feet. Yield on 5" ~~hours'~~ days' test 4000 gallons per hr (with pump of capacity g.p.h.); depressing water level to 110 feet below top. Time of recovery hrs. Amount normally pumped daily g.p.h. for hours.

Quality (attach copy of analysis if available)

Sunk by Richardson–Timmins, Ltd. for Mr. Date of well 1939

Information from T. Richardson, Ltd.

(For Survey use only). GEOLOGICAL CLASSIFICATION.	NATURE OF STRATA (and any additional remarks).	THICKNESS Feet.	THICKNESS Inches.	DEPTH Feet.	DEPTH Inches.
	Top soil	1	6	1	6
	Brash	4	.	5	6
Cornbrash	Hard brash	3	.	8	6
9 ft.	Light blue rock	2	.	6	6
	Light blue clay	2	.	10	6
Forest	Blue rock and layers of clay	2	.	14	6
Marble	Very hard grey rock	2	.	16	6
10½ ft.	Grey clay	3	6	21	.
	Grey hard Limestone Rock	5	.	26	.
White	Blue sandy clay	1	6	27	6
Limestone	Light limestone rock	7	6	35	.
38½ ft.	Grey rock	24	6	59	6
	Blue clay	1	6	61	.
Hampen	Light grey rock	2	.	63	.
Marly Beds	Light blue rock	1	6	64	6
21½ ft.	Grey rock	2	6	67	.
	Blue clay, layers of rock	14	.	81	.
Taynton	Grey rock	5	.	86	.
Stone	Rock with layers of clay	8	.	94	.
20 ft.	Grey rock	7	.	101	.
	Fine grey sandstone	4	.	105	.
	Dark brown clay	1	6	106	6
	Fine grey sandstone	4	.	110	6
Sweford and	Hard sandstone	4	.	114	6
Hook Norton	~~Blue clay~~	~~6~~	~~6~~	~~121~~	.
Beds.	~~Hard dark grey rock~~	3	6		
23½ ft.	~~Blue clay~~				
	Fine grey sandstone	6	6	121	.
	Hard Sandstone	3	6	124	6
	Blue clay	5	.	129	6
Upper Lias	Hard dark grey rock	2	6	132	.
15½ ft.	Blue clay	8	.	140	

* R.W.L. 12 ft. down in May 1940, 3 ft. down in Aug. 1939.

ALW. 10.10.40

For Survey use only

123 A

APPENDIX C – THAMES WATER SEWER RECORDS

Asset location search

Property Searches

Andrew Collins
Ridge & Partners LLP
The Cowyards The Cowyards, Blenheim Road
Oxford Road
WOODSTOCK
OX20 1QR

Search address supplied

459787 223840
Land Adjacent To Oxford Vitality
Unit 4
Longlands Road
Launton
Bicester
OX26 5AH

Your reference 5012836

Our reference ALS/ALS Standard/2020_4232200

Search date 14 August 2020

Knowledge of features below the surface is essential for every development

The benefits of this knowledge not only include ensuring due diligence and avoiding risk, but also being able to ascertain the feasibility of any development.

Did you know that Thames Water Property Searches can also provide a variety of utility searches including a more comprehensive view of utility providers' assets (across up to 35-45 different providers), as well as more focused searches relating to specific major utility companies such as National Grid (gas and electric).

Contact us to find out more.

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW
DX 151280 Slough 13

searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0845 070 9148

Search address supplied: 459787 223840, Land Adjacent To Oxford Vitality, Unit 4, Longlands Road, Launton, Bicester, OX26 5AH

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 searchprovides maps showing the position, 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 0845 070 9148, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Waste Water Services

Please provide a copy extract from the public sewer map.

The following quartiles have been printed as they fall within Thames' sewerage area:

SP5924SW
SP5923NW
SP5923NE

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.

This report 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.

The following quartiles have not been printed as they contain no assets:

SP6023NW
SP5924SE

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.

The following quartiles have been printed as they fall within Thames' water area:

SP6023NW
SP5924SW
SP5923NW
SP5923NE

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0800 316 9800. The Customer Centre can also arrange for a full flow and pressure test to be carried out for a fee.

The following quartiles have not been printed as they contain no assets:

SP5924SE

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.

Payment for this Search

Thank you for your payment covering the cost of this enquiry. We have enclosed a VAT Receipt for your records.

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. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational 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

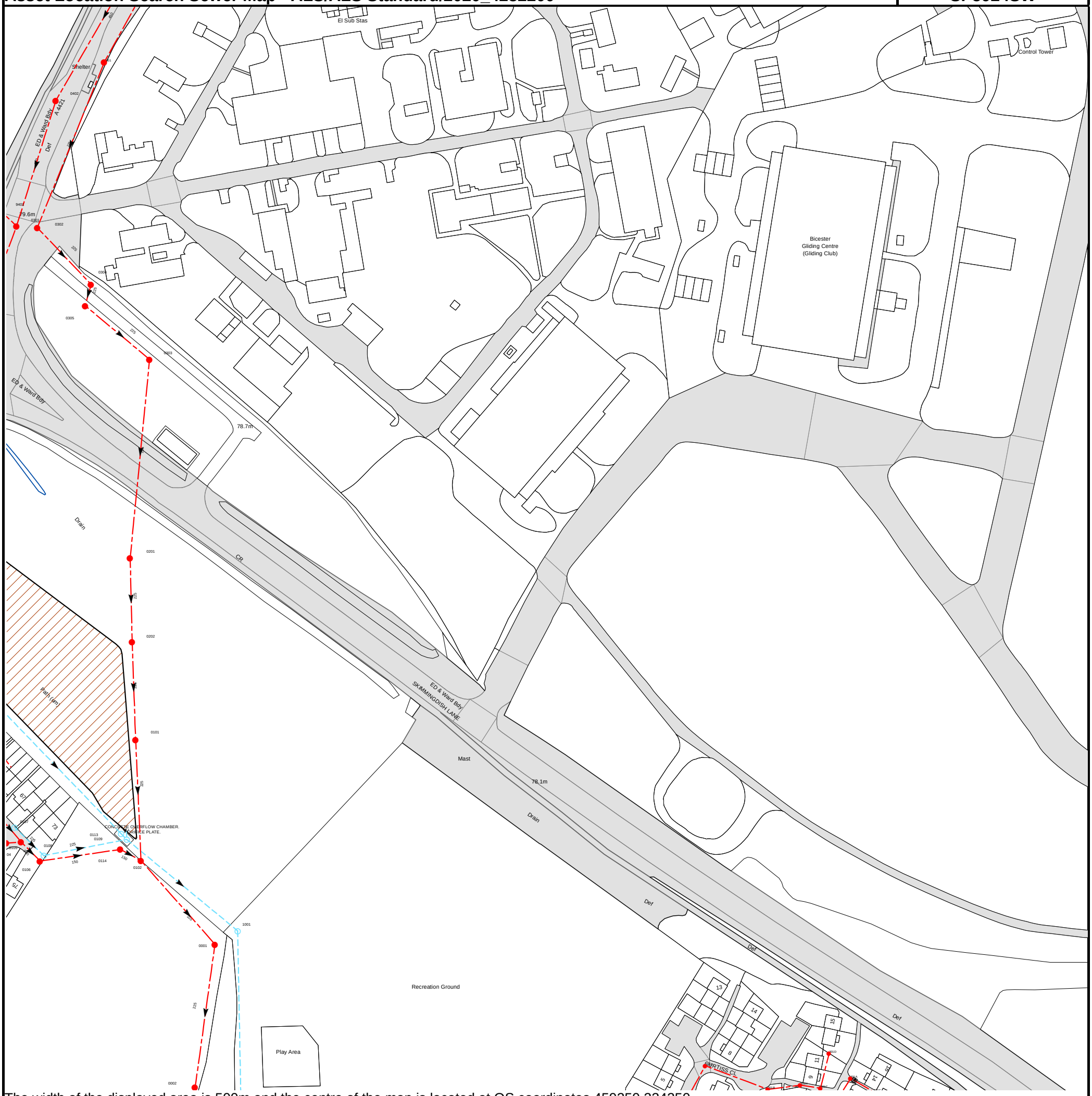
Should you require any advice concerning clean water operational issues or clean water connections, please contact:

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/2020_4232200

SP5924SW



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 459250,224250

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 with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

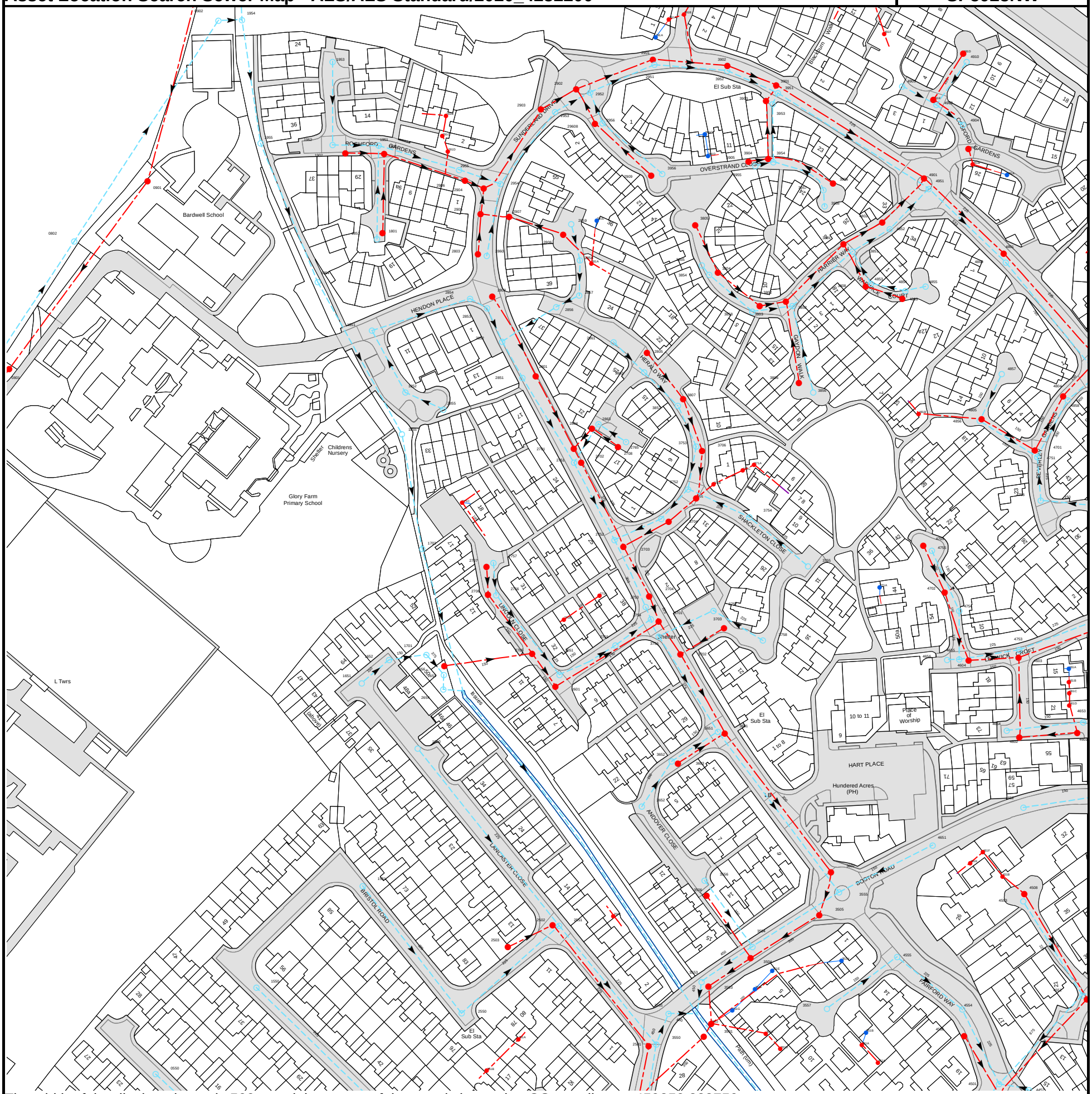
NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
301B	n/a	n/a
301H	n/a	n/a
301C	n/a	n/a
301D	n/a	n/a
301A	n/a	n/a
301G	n/a	n/a
0106	n/a	n/a
0102	77.87	76.65
0108	n/a	n/a
0114	n/a	n/a
0104	n/a	n/a
0105	n/a	n/a
0109	n/a	n/a
0113	n/a	n/a
0107	n/a	n/a
0101	n/a	n/a
0202	n/a	n/a
0201	n/a	n/a
0002	n/a	n/a
0001	77.72	76.44
1001	n/a	n/a
0303	n/a	n/a
0305	n/a	n/a
0304	79.42	78.28
0302	79.52	78.48
0301	79.67	78.03
0402	80.37	78.27
0401	80.61	79.04

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 Map - ALS/ALS Standard/2020_4232200

SP5923NW



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 459250,223750

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 459250,223750

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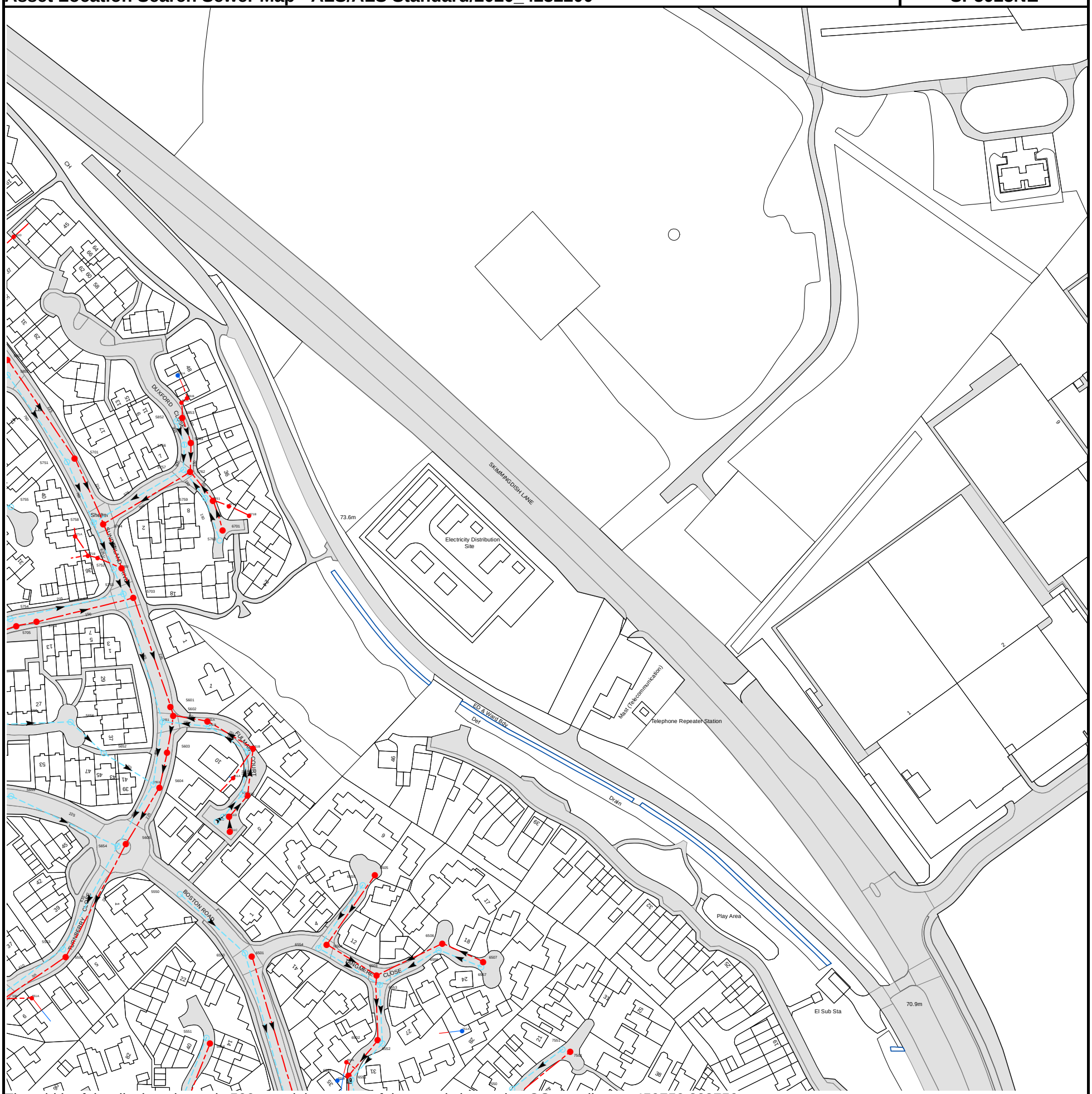
NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
4653	74.07	72.52
461D	n/a	n/a
461C	n/a	n/a
461B	n/a	n/a
461A	n/a	n/a
4604	73.89	72.79
4656	73.72	71.92
4655	73.96	72.71
4603	73.92	71.97
4753	74.05	72.35
4754	73.97	72.93
4702	73.89	72.66
471A	n/a	n/a
3755	n/a	n/a
4755	74	73.23
4703	74.02	71.7
4756	73.55	72.34
4751	73.8	72.2
4701	73.86	72.61
4856	74.54	73.16
4805	74.6	73.58
481B	n/a	n/a
4858	n/a	n/a
4804	73.84	72.32
3856	n/a	n/a
3806	n/a	n/a
4857	74.67	73.31
4803	n/a	n/a
4854	n/a	n/a
3808	n/a	n/a
4855	n/a	n/a
4853	n/a	n/a
4860	n/a	n/a
4801	n/a	n/a
3851	n/a	n/a
3801	n/a	n/a
4852	n/a	n/a
4802	n/a	n/a
3958	n/a	n/a
3957	n/a	n/a
4951	n/a	n/a
3906	n/a	n/a
3902	n/a	n/a
3905	n/a	n/a
3955	n/a	n/a
3903	n/a	n/a
3904	n/a	n/a
3953	n/a	n/a
3954	n/a	n/a
3901	n/a	n/a
3951	n/a	n/a
391E	n/a	n/a
391F	n/a	n/a
491F	n/a	n/a
4905	n/a	n/a
4901	n/a	n/a
491E	n/a	n/a
4902	74.27	72.99
4904	n/a	n/a
491D	n/a	n/a
4910	74.73	73.34
491C	n/a	n/a
491B	n/a	n/a
491A	n/a	n/a
2755	n/a	n/a
2708	n/a	n/a
2703	n/a	n/a
2765	n/a	n/a
2862	n/a	n/a
2753	n/a	n/a
2805	n/a	n/a
2704	n/a	n/a
2754	n/a	n/a
3756	n/a	n/a
3701	n/a	n/a
3751	n/a	n/a
3704	n/a	n/a
3857	n/a	n/a
3702	n/a	n/a
3807	n/a	n/a
3752	n/a	n/a
3753	n/a	n/a
3705	n/a	n/a
3706	n/a	n/a
3757	n/a	n/a
371B	n/a	n/a
3703	n/a	n/a
371C	n/a	n/a
3754	n/a	n/a
371A	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
3758	n/a	n/a
1652	75.9	74.51
1855	n/a	n/a
1852	n/a	n/a
1702	n/a	n/a
1701	76.08	74.43
2654	75.7	74.3
2855	n/a	n/a
2653	75.82	74.39
2656	75.7	74.62
271C	n/a	n/a
2707	n/a	n/a
2706	n/a	n/a
2757	n/a	n/a
2756	n/a	n/a
2851	n/a	n/a
2705	75.21	73.49
2801	n/a	n/a
2601	n/a	n/a
2651	n/a	n/a
271B	n/a	n/a
2701	n/a	n/a
2751	n/a	n/a
2702	n/a	n/a
2804	n/a	n/a
2863	n/a	n/a
271A	n/a	n/a
2752	n/a	n/a
1951	n/a	n/a
1901	n/a	n/a
291C	n/a	n/a
291B	n/a	n/a
291D	n/a	n/a
2955	n/a	n/a
2903	n/a	n/a
2953	n/a	n/a
2902	n/a	n/a
2952	n/a	n/a
29608	n/a	n/a
2956	n/a	n/a
2909	n/a	n/a
2901	n/a	n/a
2951	n/a	n/a
291A	n/a	n/a
3956	n/a	n/a
391A	n/a	n/a
391B	n/a	n/a
391C	n/a	n/a
391D	n/a	n/a
3952	n/a	n/a
1853	n/a	n/a
1801	n/a	n/a
2906	n/a	n/a
2854	n/a	n/a
2803	n/a	n/a
2905	n/a	n/a
2904	n/a	n/a
2860	n/a	n/a
2853	n/a	n/a
2802	n/a	n/a
2954	n/a	n/a
2852	n/a	n/a
2907	n/a	n/a
2856	n/a	n/a
2806	n/a	n/a
2859	n/a	n/a
2857	n/a	n/a
2858	n/a	n/a
281A	n/a	n/a
291E	n/a	n/a
2861	n/a	n/a
3805	n/a	n/a
3855	n/a	n/a
3854	n/a	n/a
3804	n/a	n/a
3858	n/a	n/a
3803	n/a	n/a
3802	n/a	n/a
3852	n/a	n/a
0801	n/a	n/a
1651	75.93	74.58
1551	75.64	74.66
1851	n/a	n/a
0802	n/a	n/a
0901	n/a	n/a
0902	n/a	n/a
1954	n/a	n/a
1955	n/a	n/a
1854	n/a	n/a
1953	n/a	n/a
1952	n/a	n/a
1902	n/a	n/a
4501	72.26	70.8

Manhole Reference	Manhole Cover Level	Manhole Invert Level
451B	n/a	n/a
4654	74.27	72.8
4602	74.2	72.05
4553	73.2	71.65
4652	74.11	72.36
4508	n/a	n/a
4452	n/a	70.89
4601	74.05	72.33
4552	72.4	70.88
4502	n/a	n/a
451A	n/a	n/a
351D	n/a	n/a
351A	n/a	n/a
4506	73.07	71
351B	n/a	n/a
4554	72.75	71.38
3557	73.37	71.93
351H	n/a	n/a
4555	73.15	71.55
3505	n/a	n/a
3555	n/a	n/a
3602	n/a	n/a
461E	n/a	n/a
461F	n/a	n/a
4651	n/a	n/a
2501	74.36	72.4
3550	74.35	72.69
3501	74.39	72.46
351C	n/a	n/a
3502	n/a	n/a
3551	74.36	72.52
351G	n/a	n/a
351F	n/a	n/a
3503	n/a	n/a
3553	n/a	n/a
351E	n/a	n/a
3504	n/a	n/a
3554	n/a	n/a
3506	n/a	n/a
3556	n/a	n/a
2652	n/a	n/a
3603	n/a	n/a
3652	n/a	n/a
3601	n/a	n/a
3651	n/a	n/a
1650	75.49	74.53
2550	75.19	73.67
251B	n/a	n/a
2503	75.06	73.66
251A	n/a	n/a
2502	74.79	73.48
2551	74.76	73.13
251C	n/a	n/a
0550	76.63	75.2
1550	75.62	74.47

Asset Location Search Sewer Map - ALS/ALS Standard/2020_4232200	SP5923NE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 459750,223750

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

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

Manhole Reference	Manhole Cover Level	Manhole Invert Level
6503	n/a	n/a
6557	n/a	n/a
6507	n/a	n/a
6501	n/a	n/a
6550	n/a	n/a
6556	n/a	n/a
6554	n/a	n/a
6504	n/a	n/a
6506	n/a	n/a
5550	n/a	n/a
6555	n/a	n/a
6505	n/a	n/a
5654	73.28	71.07
5605	73.18	69.18
661C	n/a	n/a
561C	n/a	n/a
661H	n/a	n/a
661D	n/a	n/a
661E	n/a	n/a
661G	n/a	n/a
5604	73.08	70.11
5653	73.07	71.09
661A	n/a	n/a
5652	73.72	71.92
5603	73.2	70.26
661F	n/a	n/a
661B	n/a	n/a
5758	n/a	n/a
571C	n/a	n/a
5764	n/a	n/a
5752	73.67	71.27
5702	73.65	70.6
5753	73.7	71.25
5703	73.7	70.55
5651	73.37	71.17
5601	73.47	70.32
5602	73.32	70.32
5852	n/a	n/a
581A	n/a	n/a
581C	n/a	n/a
5853	n/a	n/a
5757	n/a	n/a
5756	n/a	n/a
581B	n/a	n/a
5762	n/a	n/a
5763	n/a	n/a
5759	n/a	n/a
561A	n/a	n/a
561B	n/a	n/a
5761	n/a	n/a
5760	n/a	n/a
6701	n/a	n/a
671A	n/a	n/a
671B	n/a	n/a
5656	73.71	72.13
5705	74.12	71.32
5704	74.05	71.15
5754	74.13	71.98
571B	n/a	n/a
571A	n/a	n/a
5755	73.38	72.58
5751	73.41	71.45
5701	73.38	70.88
5851	73.65	71.57
5801	73.66	71.09
581D	n/a	n/a
7550	n/a	n/a
7551	n/a	n/a
7501	n/a	n/a
5551	n/a	n/a
5554	n/a	n/a
651B	n/a	n/a
651A	n/a	n/a
6557	n/a	n/a
6551	n/a	n/a
6502	n/a	n/a
6553	n/a	n/a
6552	n/a	n/a
751A	n/a	n/a
5655	73.77	71.9
551A	n/a	n/a
5553	72.54	70.01
5501	72.36	69.84

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.

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

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

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

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

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

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

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

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

Control Valve

Drop Pipe

Ancillary

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.

Outfall

Undefined End

Inlet

Other Symbols

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

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plans are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate 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 level indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. 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 present on the plan, please contact a member of Property Insight on 0845 070 9148.

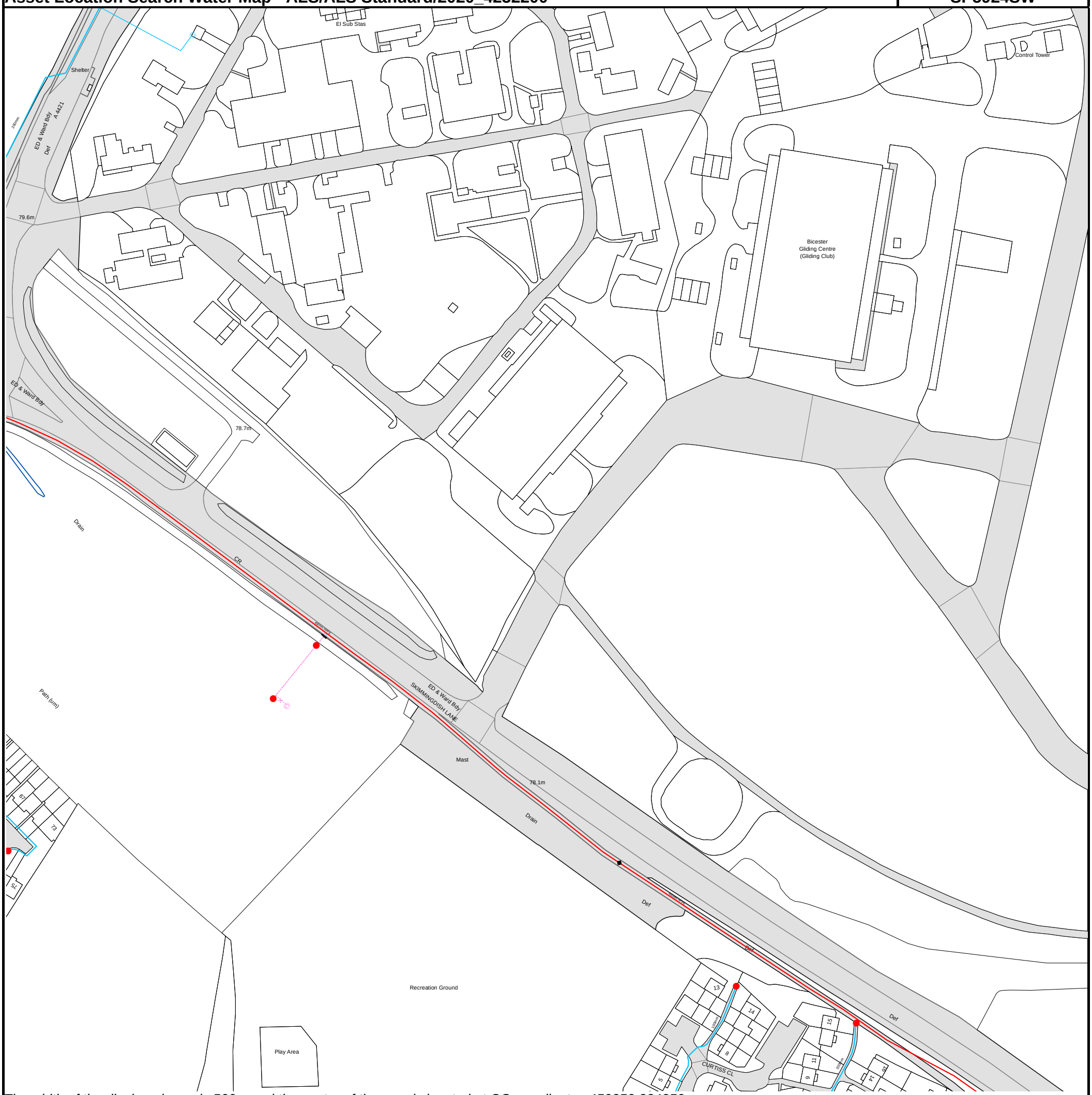
Asset Location Search Water Map - ALS/ALS Standard/2020_4232200	SP6023NW

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 460250,223750

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 Water Map - ALS/ALS Standard/2020_4232200

SP5924SW



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 459250,224250

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.

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Asset Location Search Water Map - ALS/ALS Standard/2020_4232200

SP5923NW

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 459250,223750

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.

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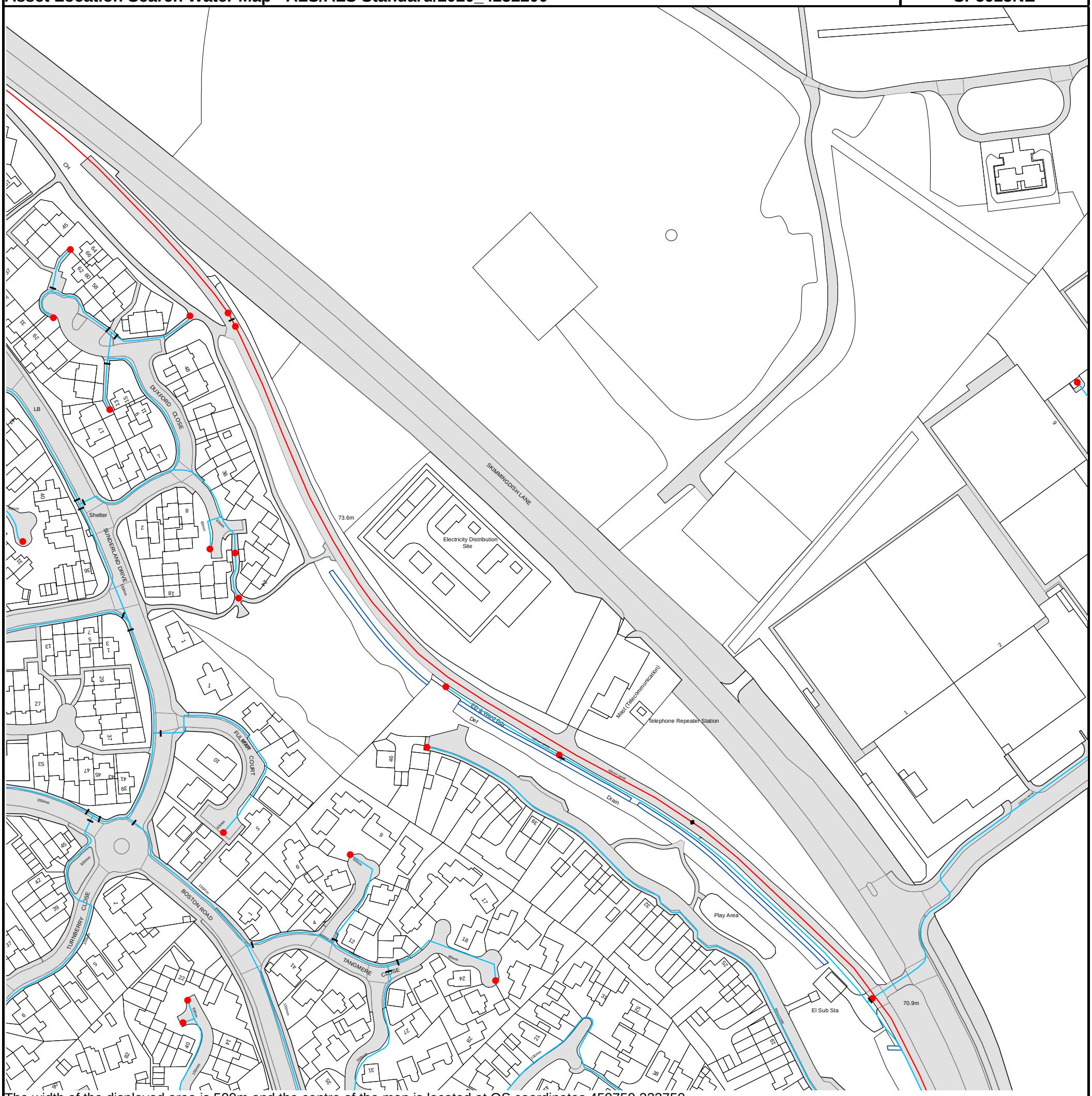
Asset Location Search Water Map - ALS/ALS Standard/2020_4232200	SP5923NE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 459750,223750

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.

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16"

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

3" SUPPLY

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Terms and Conditions

All sales are made in accordance with Thames Water Utilities Limited (TWUL) standard terms and conditions unless previously agreed in writing.

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment 14 days from due date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service, or will be held to be invalid.
4. Thames Water does not accept post-dated cheques-any cheques received will be processed for payment on date of receipt.
5. In case of dispute TWUL`s terms and conditions shall apply.
6. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
7. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
8. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (cashoperations@thameswater.co.uk).

We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0800 316 9800

If you are unhappy with our service you can speak to your original goods or customer service provider. If you are not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to her at: Thames Water Utilities Ltd. PO Box 492, Swindon, SN38 8TU.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0121 345 1000 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

Ways to pay your bill

Credit Card	**BACS Payment**	**Telephone Banking**	**Cheque**
Call **0845 070 9148** quoting your invoice number starting CBA or ADS / OSS	Account number **90478703** Sort code **60-00-01** A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.** or email **ps.billing@thameswater.co.uk**	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number	Made payable to '**Thames Water Utilities Ltd**' Write your Thames Water account number on the back. Send to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW** or by DX to **151280 Slough 13**

Thames Water Utilities Ltd Registered in England & Wales No. 2366661 Registered Office Clearwater Court, Vastern Rd, Reading, Berks, RG1 8DB.

INVOICE

Andrew Collins
Ridge & Partners LLP

Oxford Road
Woodstock
OX20 1QR

Thames Water Utilities Ltd.
PO Box 3189
Slough
SL1 4WW

Customer Reference: 5012836
Customer Number: ADS119185
Purchase Order No:

Invoice No: ADS20405852
Our Ref: ALS/ALS Standard/2020_4232200
Posting Date: 14-08-2020
Due Date: 28-08-2020

Search Address Supplied: 459787 223840, Land Adjacent To Oxford Vitality, Unit 4, Longlands Road, Launton, Bicester, OX26 5AH

Description of Charges	Qty	Unit Price	VAT (20%)	Amount (Inc VAT)
Asset Location Search	1	£49.80	£9.96	£59.76

Thank you for your payment of 000000,111111 £59.76

OUTSTANDING AMOUNT (Inc. VAT) £0.00

Please send any outstanding amount to Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.

For queries please contact the Property Searches Customer Support Team on Tel: 0845 070 9148.

VAT Reg. No GB 537456915

APPENDIX D – OUTLINE DRAINAGE STRATEGY

NOTES

1. This drawing shall be read in conjunction with the civil engineering specification, and all relevant Architect's and Engineer's drawings.
2. This document must not be altered, reproduced or distributed without prior written consent of the originator.
3. Do not scale from this document – use figured dimensions only. All dimensions must be checked on site prior to commencement of any related works.
4. Contractor to provide and have an approved method statement prior to works.
5. All setting out to be in accordance with the Architects drawings. Any discrepancies between Ridge and the Architects drawings to be referred to the Architect before proceeding. Dimensions must not be scaled.
6. All levels are in metres above ordnance datum.
7. The Contractor is to comply full with CDM regulations in the course of constructing the works.
8. At the commencement of the works, the Contractor is to carry out trial pits and liaise with utility companies in order to establish the exact position of all existing utility plant in the vicinity of the works and take adequate precautions for their protection.
9. The Contractor is to refer to Health and Safety Executive 'Note 47 – Avoiding Danger from Underground Services' and 'Document G56 – Avoiding Danger from Overhead Electric Lines.'
10. Works on or adjacent to existing public highway will be executed in accordance with the Traffic Safety Code for Road Works and Traffic Signs Manual: Chapter 8.
11. The Contractor will ascertain the CBR value of the subgrade in order to determine the required sub-base / capping thickness. Prior to laying any material, the subgrade must be inspected and any soft spots removed and filled with 6F2 capping material.
12. Prior to the construction of any drainage works, the Contractor is to confirm the invert levels of existing manholes, drains and sewers. Any variations from the designed levels shown on the drawings must be reported to the Drainage Engineer in advance of construction works commencing. All new sewers and drains are to be laid in sequence starting from the outfall location.
13. All drainage to be installed in accordance with relevant Building Regulation documents and current Sewers for Adoption. Connections to public sewers are to be agreed and inspection by the Water Authority.
14. All drain and sewer pipes are ø100mm and laid soffit to soffit, unless shown otherwise.
15. Invert to base of soil stack bends to be 450mm below lowest branch connection for up to three storey buildings; for buildings up to five storeys, the invert to the base of soil stack bends should not be less than 750mm. All foul and surface water drainage stacks are to have above ground rodding access. Refer to above ground drainage layout(s) by others.
16. All below ground connections are to match above ground outlet size, minimum ø100mm. SVPs are to project 100mm above finished floor level.
17. All internal manholes and inspection chambers to have double sealed recessed covers to suit floor finishes as defined by the Architect.
18. All external covers in non-asphalt areas are to have recessed covers to suit the paving material.
19. A CCTV survey and report in WINCAN format for all new drainage will be required prior to 'as built' drawing being issued.
20. The Contractor is responsible for the traffic safety and management associated with the construction of the works. Works will not commence on the existing highway until their traffic management proposals have been agreed with Highway Authority.
21. Where the works involve the obstruction of a footway, the Contractor will provide an alternative safe footway properly signed, guarded and lit.
22. Where one-way traffic is unavoidable, traffic will be controlled by a proper system of vehicle-actuated traffic signals or manual stop / go signs and during the hours of darkness, by a proper system of vehicle-actuated traffic signals, all to the approval of Highway Authority.
23. 65mm Minimum thickness tactile paving, coloured buff will be incorporated at all pedestrian crossings in accordance with the Department for Transport and Regions document "Guidance on the Use of Tactile Paving Surfaces." (DETR No. 1998)
24. All signs and road markings will be in accordance with the "Traffic Signs Regulations and General Directions 2016". (TSRGD 2016)
25. All excavation and backfilling work in the existing highway to be in accordance with the provisions of the New Street Works Act 1991 or that specified on the working drawings.
26. All highways works to be carried out in accordance with Highway Authority's highway standards, to the satisfaction of the Highway Authority Section 278 Inspector and in accordance with the Specification for Highway Works.
27. Gullies, gully connections, drains, manholes, catch pit, soakaways, headwalls and other drainage structures intended to convey only highway water are to be constructed in accordance with the specification of Highway Authority and to the satisfaction of the Highway Inspector.
28. Where existing junctions and accesses are to remain in operation within the works during the construction process, the Contractor will ensure that access to these units remains available at all times.
29. Highways in the vicinity of the works must be kept free from mud, debris and dust falling from vehicles or wheels of vehicles connected with the works. Where the deposits of debris and mud are unavoidable, warning signs must be displayed whilst work is in progress and affected carriageways / footways must be regularly cleaned.

Source:

- Topographical survey by On Centre Surveys Drawing No. 25557Q-1 dated 04/08/2021
- Architect's layout by ? Drawing No. ? dated ?

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DRAWING NOTES:

CDM REGULATIONS 2015
SIGNIFICANT OR NON-OBVIOUS RISKS AND RISKS WHICH ARE DIFFICULT TO MANAGE ARE IDENTIFIED ON THIS DRAWING USING THE FOLLOWING SYMBOL IDENTIFIED TO THE RIGHT WITH BRIEF ACCOMPANYING TEXT. FOR FURTHER DETAILS OF THE RISKS IDENTIFIED BY DESIGNERS, REFERENCE SHOULD BE MADE TO CDM HAZARD REGISTER.

REV	DESCRIPTION	DATE	BY	CHKD
P02	Surface water drainage strategy revised	03/12/2021	AJC	SW
P01	First issue	27/11/2020	BN	SW

ORIGINATOR:

RIDGE

THE COWYARDS
BLENHEIM PARK
OXFORD ROAD
WOODSTOCK, OX20 1QR

TEL: 01993 815000
WWW.RIDGE.CO.UK

CLIENT:

BICESTER MOTION

IN ASSOCIATION WITH:

PROJECT:

BICESTER MOTION
EXPERIENCE QUARTER CENTRE

TITLE:

SURFACE WATER
DRAINAGE STRATEGY

ENG/TECH:	CSE:	ICSE:	SCALE: 1:2000 @ A0
BN	SW	AJC	STATUS ISSUE: 27/11/2020

STATUS: PRELIMINARY

UNLESS ISSUED FOR CONSTRUCTION - WORKS AT CLIENT/CONTRACTORS RISK

ISO 19650 STATUS: S0 - Work in Progress

PROJECT:	ORG:	ZONE:	LEVEL:	TYPE:	ROLE:	NUMBER:	REV:
5013504	RDG	XX	XX	DR	C	0501	P02

APPENDIX E – ARCHITECTS SITE LAYOUT

KEY:

- Application Boundary
- Ownership Boundary
- SAM
- Indicative Massing

N

Experience Quarter - Indicative Layout Plan

PLANNING

DRAWN BY: JY CHECKED BY: AH

PROJECT: ORG: ZONE: LEVEL: TYPE:

5002854-RDG-Z01-ST-PL-A-0030 REV: G 15/04/2019

SCALE 1 : 5000 @ A1

REV	DESCRIPTION	DATE	BY	CHKD
G	Car park Update	16/11/2020	JY	LS
F	Application Boundary Line, Buckingham Road Entrance Update	12/11/2020	JY	LS
E	Runway & Tracks Update	29/09/2020	JY	LS
D	Status and Graphic Update	11/02/2020	JY	AH
C	Track naming updated	01/08/2019	JY	AH
B	Application boundary line and ownership boundary line updated	03/07/2019	JY	AH
A	Application boundary line updated	25/06/2019	JY	AH

RIDGE

THE COWYARDS
BLENHEIM PARK, OXFORD ROAD
WOODSTOCK
OX20 1QR

TEL NO: 01993815000

WWW.RIDGE.CO.UK

APPENDIX F – PERCOLATION TEST RESULTS

Soakaway Test Results & Soil Infiltration Rate

Bicester Heritage - Experience Quarter

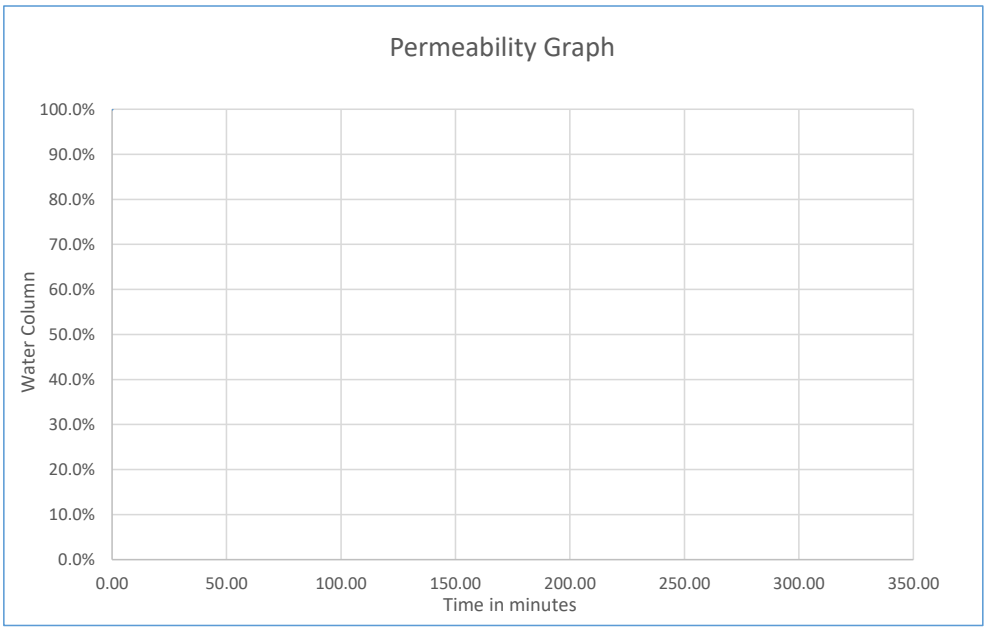
Project: 5013504 **Hole ID: TP1** **Test 1**

Time in minutes	Depth in metres to water surface	Depth in metres of water	Percentage of water depth at start
0.00	0.140	0.46	100.0%
2.00	0.005	0.60	129.3%
2.20	0.000	0.60	130.4%
		0.60	130.4%
		0.60	130.4%
		0.60	130.4%
		0.60	130.4%
		0.60	130.4%
		0.60	130.4%
		0.60	130.4%
		0.60	130.4%
		0.60	130.4%
		0.60	130.4%
		0.60	130.4%
		0.60	130.4%
		0.60	130.4%
		0.60	130.4%
		0.60	130.4%
		0.60	130.4%
		0.60	130.4%
		0.60	130.4%
305.00	**1.820**	**-1.22**	**-265.2%**

INFILTRATION CALCULATED FROM 75%-25% WATER DEPTH RANGE

Pit Size		Time in mins	
Length	1.20	0.55	75%
Width	0.60	1.65	25%
Depth	0.60		

Infiltration Rate from75%-25% **1.62E-03**



Soakaway Test Results & Soil Infiltration Rate

Bicester Heritage - Experience Quarter

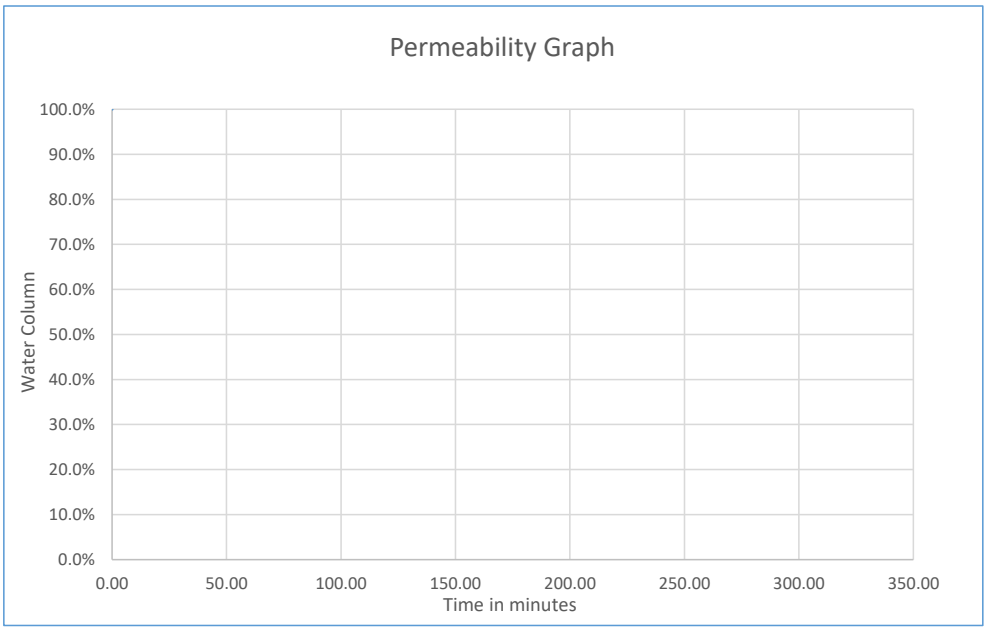
Project: 5013504 **Hole ID: TP1** **Test 2**

Time in minutes	Depth in metres to water surface	Depth in metres of water	Percentage of water depth at start
0.00	0.150	0.45	100.0%
2.00	0.080	0.52	115.6%
4.00	0.005	0.60	132.2%
4.87	0.000	0.60	133.3%
		0.60	133.3%
		0.60	133.3%
		0.60	133.3%
		0.60	133.3%
		0.60	133.3%
		0.60	133.3%
		0.60	133.3%
		0.60	133.3%
		0.60	133.3%
		0.60	133.3%
		0.60	133.3%
		0.60	133.3%
		0.60	133.3%
		0.60	133.3%
		0.60	133.3%
		0.60	133.3%
		0.60	133.3%
305.00	**1.820**	**-1.22**	**-271.1%**

INFILTRATION CALCULATED FROM 75%-25% WATER DEPTH RANGE

Pit Size		Time in mins	
Length	1.20	1.22	75%
Width	0.60	3.65	25%
Depth	0.60		

Infiltration Rate from75%-25% **7.26E-04**



Soakaway Test Results & Soil Infiltration Rate

Bicester Heritage - Experience Quarter

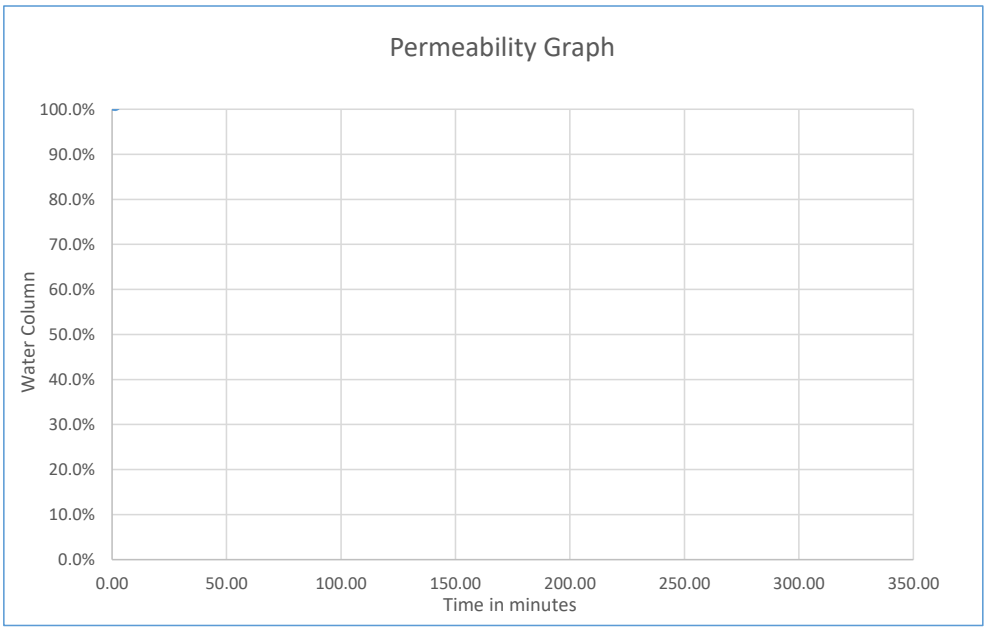
Project: 5013504 **Hole ID: TP3** **Test 1**

Time in minutes	Depth in metres to water surface	Depth in metres of water	Percentage of water depth at start
0.00	0.300	0.90	100.0%
2.00	0.300	0.90	100.0%
4.00	0.293	0.91	100.8%
6.00	0.293	0.91	100.8%
8.00	0.293	0.91	100.8%
10.00	0.293	0.91	100.8%
15.00	0.293	0.91	100.8%
20.00	0.293	0.91	100.8%
25.00	0.291	0.91	101.0%
30.00	0.291	0.91	101.0%
40.00	0.291	0.91	101.0%
50.00	0.290	0.91	101.1%
60.00	0.290	0.91	101.1%
80.00	0.285	0.92	101.7%
100.00	0.281	0.92	102.1%
134.00	0.255	0.95	105.0%
324.00	0.170	1.03	114.4%
		1.20	133.3%
		1.20	133.3%
305.00	**1.820**	**-0.62**	**-68.9%**

INFILTRATION CALCULATED FROM 75%-25% WATER DEPTH RANGE

Pit Size		Time in mins	
Length	1.20	81	75%
Width	0.60	243	25%
Depth	1.20		

Infiltration Rate from75%-25% **1.42E-05**



APPENDIX G – MICRODRAINAGE CALCULATIONS

Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	20.000	Winter Storms	Yes	Shortest Storm (mins)	15
Return Period (years)	100	Ratio R	0.400	Cv (Summer)	1.000	Longest Storm (mins)	10080
Region	England and Wales	Summer Storms	Yes	Cv (Winter)	1.000	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.185

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	5	0.063	5	10	0.061	10	15	0.061

Model Details

Storage is Online Cover Level (m) 78.100

Infiltration Basin Structure

Invert Level (m) 76.100 Infiltration Coefficient Side (m/hr) 0.03600 Porosity 1.00
Infiltration Coefficient Base (m/hr) 0.03600 Safety Factor 2.0

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	12.5	2.000	314.0

Pump Outflow Control

Invert Level (m) 76.100

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.0000	0.600	0.0000	1.100	0.0000	1.600	0.0000	2.100	0.0000	2.600	0.0000
0.200	0.0000	0.700	0.0000	1.200	0.0000	1.700	0.0000	2.200	0.0000	2.700	0.0000
0.300	0.0000	0.800	0.0000	1.300	0.0000	1.800	0.0000	2.300	0.0000	2.800	0.0000
0.400	0.0000	0.900	0.0000	1.400	0.0000	1.900	0.0000	2.400	0.0000	2.900	0.0000
0.500	0.0000	1.000	0.0000	1.500	0.0000	2.000	0.0000	2.500	0.0000	3.000	0.0000

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 607 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	77.168	1.068	1.4	0.0	1.4	62.4	O K
30 min Summer	77.308	1.208	1.7	0.0	1.7	81.3	O K
60 min Summer	77.428	1.328	1.9	0.0	1.9	100.0	O K
120 min Summer	77.524	1.424	2.0	0.0	2.0	117.0	O K
180 min Summer	77.566	1.466	2.1	0.0	2.1	124.9	O K
240 min Summer	77.586	1.486	2.1	0.0	2.1	128.9	O K
360 min Summer	77.602	1.502	2.2	0.0	2.2	132.1	O K
480 min Summer	77.603	1.503	2.2	0.0	2.2	132.4	O K
600 min Summer	77.601	1.501	2.2	0.0	2.2	132.1	O K
720 min Summer	77.598	1.498	2.2	0.0	2.2	131.4	O K
960 min Summer	77.589	1.489	2.1	0.0	2.1	129.6	O K
1440 min Summer	77.563	1.463	2.1	0.0	2.1	124.4	O K
2160 min Summer	77.515	1.415	2.0	0.0	2.0	115.4	O K
2880 min Summer	77.467	1.367	1.9	0.0	1.9	106.7	O K
4320 min Summer	77.376	1.276	1.8	0.0	1.8	91.7	O K
5760 min Summer	77.297	1.197	1.6	0.0	1.6	79.7	O K
7200 min Summer	77.227	1.127	1.5	0.0	1.5	70.0	O K
8640 min Summer	77.166	1.066	1.4	0.0	1.4	62.1	O K
10080 min Summer	77.111	1.011	1.4	0.0	1.4	55.6	O K
15 min Winter	77.168	1.068	1.4	0.0	1.4	62.4	O K
30 min Winter	77.309	1.209	1.7	0.0	1.7	81.4	O K
60 min Winter	77.428	1.328	1.9	0.0	1.9	100.1	O K
120 min Winter	77.525	1.425	2.0	0.0	2.0	117.3	O K
180 min Winter	77.568	1.468	2.1	0.0	2.1	125.3	O K
240 min Winter	77.589	1.489	2.1	0.0	2.1	129.5	O K
360 min Winter	77.606	1.506	2.2	0.0	2.2	133.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.153	0.0	63.0	29
30 min Summer	90.705	0.0	80.4	43
60 min Summer	56.713	0.0	104.9	72
120 min Summer	34.246	0.0	126.7	130
180 min Summer	25.149	0.0	139.6	188
240 min Summer	20.078	0.0	148.6	246
360 min Summer	14.585	0.0	161.9	362
480 min Summer	11.622	0.0	172.0	446
600 min Summer	9.738	0.0	180.0	500
720 min Summer	8.424	0.0	186.8	562
960 min Summer	6.697	0.0	197.0	690
1440 min Summer	4.839	0.0	208.7	964
2160 min Summer	3.490	0.0	232.5	1372
2880 min Summer	2.766	0.0	245.6	1784
4320 min Summer	1.989	0.0	265.0	2560
5760 min Summer	1.573	0.0	279.4	3344
7200 min Summer	1.311	0.0	290.9	4104
8640 min Summer	1.129	0.0	300.6	4840
10080 min Summer	0.994	0.0	309.0	5552
15 min Winter	138.153	0.0	63.0	29
30 min Winter	90.705	0.0	80.4	43
60 min Winter	56.713	0.0	104.9	72
120 min Winter	34.246	0.0	126.7	128
180 min Winter	25.149	0.0	139.6	184
240 min Winter	20.078	0.0	148.6	240
360 min Winter	14.585	0.0	161.9	352

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
480 min Winter	77.608	1.508	2.2	0.0	2.2	133.4	O K
600 min Winter	77.603	1.503	2.2	0.0	2.2	132.3	O K
720 min Winter	77.598	1.498	2.2	0.0	2.2	131.3	O K
960 min Winter	77.584	1.484	2.1	0.0	2.1	128.6	O K
1440 min Winter	77.546	1.446	2.1	0.0	2.1	121.2	O K
2160 min Winter	77.479	1.379	2.0	0.0	2.0	108.9	O K
2880 min Winter	77.412	1.312	1.8	0.0	1.8	97.5	O K
4320 min Winter	77.291	1.191	1.6	0.0	1.6	78.7	O K
5760 min Winter	77.186	1.086	1.5	0.0	1.5	64.7	O K
7200 min Winter	77.097	0.997	1.3	0.0	1.3	54.0	O K
8640 min Winter	77.019	0.919	1.2	0.0	1.2	45.7	O K
10080 min Winter	76.952	0.852	1.1	0.0	1.1	39.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
480 min Winter	11.622	0.0	172.0	460
600 min Winter	9.738	0.0	180.0	554
720 min Winter	8.424	0.0	186.8	576
960 min Winter	6.697	0.0	197.0	730
1440 min Winter	4.839	0.0	208.8	1034
2160 min Winter	3.490	0.0	232.5	1472
2880 min Winter	2.766	0.0	245.6	1888
4320 min Winter	1.989	0.0	265.0	2692
5760 min Winter	1.573	0.0	279.4	3464
7200 min Winter	1.311	0.0	290.9	4248
8640 min Winter	1.129	0.0	300.6	4936
10080 min Winter	0.994	0.0	309.0	5656

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.600

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	5	0.200	5	10	0.200	10	15	0.200

Model Details

Storage is Online Cover Level (m) 82.590

Infiltration Basin Structure

Invert Level (m) 80.590 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.03600 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.03600

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	113.0	2.000	615.5

Pump Outflow Control

Invert Level (m) 80.590

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.0000	0.700	0.0000	1.300	0.0000	1.900	0.0000	2.500	0.0000
0.200	0.0000	0.800	0.0000	1.400	0.0000	2.000	0.0000	2.600	0.0000
0.300	0.0000	0.900	0.0000	1.500	0.0000	2.100	0.0000	2.700	0.0000
0.400	0.0000	1.000	0.0000	1.600	0.0000	2.200	0.0000	2.800	0.0000
0.500	0.0000	1.100	0.0000	1.700	0.0000	2.300	0.0000	2.900	0.0000
0.600	0.0000	1.200	0.0000	1.800	0.0000	2.400	0.0000	3.000	0.0000

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 1025 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	81.587	0.997	2.8	0.0	2.8	204.1	O K
30 min Summer	81.773	1.183	3.3	0.0	3.3	266.8	O K
60 min Summer	81.938	1.348	3.8	0.0	3.8	330.2	O K
120 min Summer	82.079	1.489	4.2	0.0	4.2	390.9	O K
180 min Summer	82.148	1.558	4.4	0.0	4.4	422.2	O K
240 min Summer	82.187	1.597	4.5	0.0	4.5	440.7	O K
360 min Summer	82.231	1.641	4.6	0.0	4.6	462.3	O K
480 min Summer	82.252	1.662	4.7	0.0	4.7	473.1	O K
600 min Summer	82.261	1.671	4.7	0.0	4.7	477.5	O K
720 min Summer	82.262	1.672	4.7	0.0	4.7	477.9	O K
960 min Summer	82.258	1.668	4.7	0.0	4.7	475.9	O K
1440 min Summer	82.244	1.654	4.6	0.0	4.6	468.8	O K
2160 min Summer	82.211	1.621	4.5	0.0	4.5	452.6	O K
2880 min Summer	82.171	1.581	4.4	0.0	4.4	433.4	O K
4320 min Summer	82.088	1.498	4.2	0.0	4.2	394.6	O K
5760 min Summer	82.008	1.418	4.0	0.0	4.0	359.4	O K
7200 min Summer	81.934	1.344	3.8	0.0	3.8	328.8	O K
8640 min Summer	81.867	1.277	3.6	0.0	3.6	302.2	O K
10080 min Summer	81.806	1.216	3.4	0.0	3.4	279.0	O K
15 min Winter	81.587	0.997	2.9	0.0	2.9	204.2	O K
30 min Winter	81.773	1.183	3.3	0.0	3.3	266.9	O K
60 min Winter	81.938	1.348	3.8	0.0	3.8	330.4	O K
120 min Winter	82.081	1.491	4.2	0.0	4.2	391.4	O K
180 min Winter	82.149	1.559	4.4	0.0	4.4	423.0	O K
240 min Winter	82.189	1.599	4.5	0.0	4.5	441.9	O K
360 min Winter	82.234	1.644	4.6	0.0	4.6	464.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.153	0.0	168.6	29
30 min Summer	90.705	0.0	205.1	44
60 min Summer	56.713	0.0	338.2	74
120 min Summer	34.246	0.0	398.2	132
180 min Summer	25.149	0.0	430.6	190
240 min Summer	20.078	0.0	452.2	248
360 min Summer	14.585	0.0	482.0	366
480 min Summer	11.622	0.0	502.5	484
600 min Summer	9.738	0.0	517.1	602
720 min Summer	8.424	0.0	527.9	708
960 min Summer	6.697	0.0	541.5	810
1440 min Summer	4.839	0.0	548.3	1056
2160 min Summer	3.490	0.0	753.9	1464
2880 min Summer	2.766	0.0	795.6	1876
4320 min Summer	1.989	0.0	819.7	2688
5760 min Summer	1.573	0.0	906.1	3512
7200 min Summer	1.311	0.0	943.6	4264
8640 min Summer	1.129	0.0	975.0	5024
10080 min Summer	0.994	0.0	1002.2	5848
15 min Winter	138.153	0.0	168.6	29
30 min Winter	90.705	0.0	205.1	43
60 min Winter	56.713	0.0	338.2	72
120 min Winter	34.246	0.0	398.2	130
180 min Winter	25.149	0.0	430.6	186
240 min Winter	20.078	0.0	452.2	244
360 min Winter	14.585	0.0	482.0	358

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
480 min Winter	82.257	1.667	4.7	0.0	4.7	475.5	O K
600 min Winter	82.267	1.677	4.7	0.0	4.7	480.7	O K
720 min Winter	82.270	1.680	4.7	0.0	4.7	482.0	O K
960 min Winter	82.262	1.672	4.7	0.0	4.7	477.9	O K
1440 min Winter	82.240	1.650	4.6	0.0	4.6	467.1	O K
2160 min Winter	82.194	1.604	4.5	0.0	4.5	444.1	O K
2880 min Winter	82.138	1.548	4.3	0.0	4.3	417.7	O K
4320 min Winter	82.024	1.434	4.0	0.0	4.0	366.6	O K
5760 min Winter	81.918	1.328	3.7	0.0	3.7	322.2	O K
7200 min Winter	81.822	1.232	3.5	0.0	3.5	284.8	O K
8640 min Winter	81.735	1.145	3.2	0.0	3.2	253.4	O K
10080 min Winter	81.658	1.068	3.0	0.0	3.0	226.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
480 min Winter	11.622	0.0	502.4	472
600 min Winter	9.738	0.0	517.1	584
720 min Winter	8.424	0.0	527.9	692
960 min Winter	6.697	0.0	541.5	892
1440 min Winter	4.839	0.0	548.4	1106
2160 min Winter	3.490	0.0	753.9	1564
2880 min Winter	2.766	0.0	795.6	2020
4320 min Winter	1.989	0.0	819.9	2864
5760 min Winter	1.573	0.0	906.1	3696
7200 min Winter	1.311	0.0	943.6	4480
8640 min Winter	1.129	0.0	975.0	5280
10080 min Winter	0.994	0.0	1002.1	6056

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.500

Time (mins) From:	To:	Area (ha)
0	5	1.500

Model Details

Storage is Online Cover Level (m) 0.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.03600	Width (m)	100.0
Membrane Percolation (mm/hr)	1000	Length (m)	127.0
Max Percolation (l/s)	3527.8	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	-0.480	Cap Volume Depth (m)	0.350

Pump Outflow Control

Invert Level (m) -0.480

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.0000	0.800	0.0000	2.000	0.0000	4.000	0.0000	7.000	0.0000
0.200	0.0000	1.000	0.0000	2.200	0.0000	4.500	0.0000	7.500	0.0000
0.300	0.0000	1.200	0.0000	2.400	0.0000	5.000	0.0000	8.000	0.0000
0.400	0.0000	1.400	0.0000	2.600	0.0000	5.500	0.0000	8.500	0.0000
0.500	0.0000	1.600	0.0000	3.000	0.0000	6.000	0.0000	9.000	0.0000
0.600	0.0000	1.800	0.0000	3.500	0.0000	6.500	0.0000	9.500	0.0000

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 96 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	-0.372	0.108	63.5	0.0	63.5	412.9	O K
30 min Summer	-0.338	0.142	63.5	0.0	63.5	540.0	O K
60 min Summer	-0.313	0.167	63.5	0.0	63.5	635.8	O K
120 min Summer	-0.304	0.176	63.5	0.0	63.5	671.1	O K
180 min Summer	-0.306	0.174	63.5	0.0	63.5	663.9	O K
240 min Summer	-0.312	0.168	63.5	0.0	63.5	641.2	O K
360 min Summer	-0.327	0.153	63.5	0.0	63.5	584.1	O K
480 min Summer	-0.342	0.138	63.5	0.0	63.5	524.5	O K
600 min Summer	-0.357	0.123	63.5	0.0	63.5	467.0	O K
720 min Summer	-0.371	0.109	63.5	0.0	63.5	413.9	O K
960 min Summer	-0.395	0.085	63.5	0.0	63.5	323.7	O K
1440 min Summer	-0.425	0.055	63.5	0.0	63.5	208.8	O K
2160 min Summer	-0.439	0.041	51.8	0.0	51.8	154.5	O K
2880 min Summer	-0.447	0.033	42.2	0.0	42.2	126.4	O K
4320 min Summer	-0.455	0.025	31.4	0.0	31.4	93.6	O K
5760 min Summer	-0.460	0.020	25.1	0.0	25.1	74.5	O K
7200 min Summer	-0.464	0.016	20.6	0.0	20.6	62.4	O K
8640 min Summer	-0.466	0.014	18.1	0.0	18.1	53.5	O K
10080 min Summer	-0.467	0.013	16.2	0.3	16.2	47.7	O K
15 min Winter	-0.372	0.108	63.5	0.0	63.5	413.3	O K
30 min Winter	-0.338	0.142	63.5	0.0	63.5	540.1	O K
60 min Winter	-0.313	0.167	63.5	0.0	63.5	635.3	O K
120 min Winter	-0.306	0.174	63.5	0.0	63.5	663.4	O K
180 min Winter	-0.310	0.170	63.5	0.0	63.5	646.3	O K
240 min Winter	-0.320	0.160	63.5	0.0	63.5	610.6	O K
360 min Winter	-0.342	0.138	63.5	0.0	63.5	524.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.153	0.0	452.2	18
30 min Summer	90.705	0.0	614.0	33
60 min Summer	56.713	0.0	783.7	62
120 min Summer	34.246	0.0	958.7	100
180 min Summer	25.149	0.0	1061.5	132
240 min Summer	20.078	0.0	1132.9	166
360 min Summer	14.585	0.0	1237.7	232
480 min Summer	11.622	0.0	1316.6	300
600 min Summer	9.738	0.0	1379.4	364
720 min Summer	8.424	0.0	1431.9	426
960 min Summer	6.697	0.0	1516.4	544
1440 min Summer	4.839	0.0	1638.4	766
2160 min Summer	3.490	0.0	1762.4	1112
2880 min Summer	2.766	0.0	1849.8	1472
4320 min Summer	1.989	0.0	1968.9	2204
5760 min Summer	1.573	0.0	2047.6	2936
7200 min Summer	1.311	0.0	2103.3	3672
8640 min Summer	1.129	0.0	2143.8	4376
10080 min Summer	0.994	0.0	2173.7	5120
15 min Winter	138.153	0.0	452.2	18
30 min Winter	90.705	0.0	614.0	32
60 min Winter	56.713	0.0	783.7	60
120 min Winter	34.246	0.0	958.7	104
180 min Winter	25.149	0.0	1061.5	138
240 min Winter	20.078	0.0	1132.9	176
360 min Winter	14.585	0.0	1237.6	248

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
480 min Winter	-0.365	0.115	63.5	0.0	63.5	437.2	O K
600 min Winter	-0.386	0.094	63.5	0.0	63.5	357.6	O K
720 min Winter	-0.404	0.076	63.5	0.0	63.5	289.0	O K
960 min Winter	-0.428	0.052	63.5	0.0	63.5	196.4	O K
1440 min Winter	-0.442	0.038	48.6	0.0	48.6	145.1	O K
2160 min Winter	-0.452	0.028	35.9	0.0	35.9	106.7	O K
2880 min Winter	-0.458	0.022	28.3	0.0	28.3	84.8	O K
4320 min Winter	-0.464	0.016	20.6	0.0	20.6	61.0	O K
5760 min Winter	-0.467	0.013	16.2	0.3	16.2	47.8	O K
7200 min Winter	-0.469	0.011	13.7	0.3	13.7	40.1	O K
8640 min Winter	-0.471	0.009	11.7	0.5	11.7	34.4	O K
10080 min Winter	-0.472	0.008	10.5	0.7	10.5	30.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
480 min Winter	11.622	0.0	1316.6	316
600 min Winter	9.738	0.0	1379.4	378
720 min Winter	8.424	0.0	1431.9	434
960 min Winter	6.697	0.0	1516.4	530
1440 min Winter	4.839	0.0	1638.5	764
2160 min Winter	3.490	0.0	1762.5	1124
2880 min Winter	2.766	0.0	1850.1	1496
4320 min Winter	1.989	0.0	1969.8	2188
5760 min Winter	1.573	0.0	2049.3	2896
7200 min Winter	1.311	0.0	2105.7	3672
8640 min Winter	1.129	0.0	2146.8	4360
10080 min Winter	0.994	0.0	2177.3	5152

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.002

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	5	0.001	5	10	0.000	10	15	0.000

Model Details

Storage is Online Cover Level (m) 0.000

Filter Drain Structure

Infiltration Coefficient Base (m/hr)	0.03600	Pipe Diameter (m)	0.300
Infiltration Coefficient Side (m/hr)	0.03600	Pipe Depth above Invert (m)	0.150
Safety Factor	2.0	Slope (1:X)	0.0
Porosity	0.30	Cap Volume Depth (m)	0.000
Invert Level (m)	-1.350	Cap Infiltration Depth (m)	0.000
Trench Width (m)	1.2	Number of Pipes	1
Trench Length (m)	1.0		

Pump Outflow Control

Invert Level (m) -1.350

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.0000	0.700	0.0000	1.300	0.0000	1.900	0.0000	2.500	0.0000
0.200	0.0000	0.800	0.0000	1.400	0.0000	2.000	0.0000	2.600	0.0000
0.300	0.0000	0.900	0.0000	1.500	0.0000	2.100	0.0000	2.700	0.0000
0.400	0.0000	1.000	0.0000	1.600	0.0000	2.200	0.0000	2.800	0.0000
0.500	0.0000	1.100	0.0000	1.700	0.0000	2.300	0.0000	2.900	0.0000
0.600	0.0000	1.200	0.0000	1.800	0.0000	2.400	0.0000	3.000	0.0000

Summary of Results for 30 year Return Period

Half Drain Time : 172 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	-0.669	0.681	0.0	0.0	0.0	0.3	O K
30 min Summer	-0.447	0.903	0.0	0.0	0.0	0.4	O K
60 min Summer	-0.257	1.093	0.0	0.0	0.0	0.4	Flood Risk
120 min Summer	-0.157	1.193	0.0	0.0	0.0	0.5	Flood Risk
180 min Summer	-0.139	1.211	0.0	0.0	0.0	0.5	Flood Risk
240 min Summer	-0.141	1.209	0.0	0.0	0.0	0.5	Flood Risk
360 min Summer	-0.170	1.180	0.0	0.0	0.0	0.5	Flood Risk
480 min Summer	-0.212	1.138	0.0	0.0	0.0	0.5	Flood Risk
600 min Summer	-0.258	1.092	0.0	0.0	0.0	0.4	Flood Risk
720 min Summer	-0.304	1.046	0.0	0.0	0.0	0.4	O K
960 min Summer	-0.389	0.961	0.0	0.0	0.0	0.4	O K
1440 min Summer	-0.529	0.821	0.0	0.0	0.0	0.3	O K
2160 min Summer	-0.684	0.666	0.0	0.0	0.0	0.3	O K
2880 min Summer	-0.800	0.550	0.0	0.0	0.0	0.2	O K
4320 min Summer	-0.958	0.392	0.0	0.0	0.0	0.2	O K
5760 min Summer	-1.043	0.307	0.0	0.0	0.0	0.1	O K
7200 min Summer	-1.104	0.246	0.0	0.0	0.0	0.1	O K
8640 min Summer	-1.150	0.200	0.0	0.0	0.0	0.1	O K
10080 min Summer	-1.188	0.162	0.0	0.0	0.0	0.1	O K
15 min Winter	-0.669	0.681	0.0	0.0	0.0	0.3	O K
30 min Winter	-0.446	0.904	0.0	0.0	0.0	0.4	O K
60 min Winter	-0.253	1.097	0.0	0.0	0.0	0.4	Flood Risk
120 min Winter	-0.145	1.205	0.0	0.0	0.0	0.5	Flood Risk
180 min Winter	-0.136	1.214	0.0	0.0	0.0	0.5	Flood Risk
240 min Winter	-0.145	1.205	0.0	0.0	0.0	0.5	Flood Risk
360 min Winter	-0.193	1.157	0.0	0.0	0.0	0.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	76.035	0.0	0.3	26
30 min Summer	49.499	0.0	0.4	38
60 min Summer	30.811	0.0	0.5	64
120 min Summer	18.615	0.0	0.6	114
180 min Summer	13.715	0.0	0.7	142
240 min Summer	10.995	0.0	0.7	176
360 min Summer	8.034	0.0	0.8	244
480 min Summer	6.428	0.0	0.9	314
600 min Summer	5.404	0.0	0.9	382
720 min Summer	4.687	0.0	0.9	450
960 min Summer	3.743	0.0	1.0	584
1440 min Summer	2.723	0.0	1.1	846
2160 min Summer	1.979	0.0	1.2	1232
2880 min Summer	1.577	0.0	1.3	1612
4320 min Summer	1.143	0.0	1.4	2344
5760 min Summer	0.910	0.0	1.5	3064
7200 min Summer	0.762	0.0	1.5	3816
8640 min Summer	0.659	0.0	1.6	4504
10080 min Summer	0.583	0.0	1.6	5240
15 min Winter	76.035	0.0	0.3	26
30 min Winter	49.499	0.0	0.4	38
60 min Winter	30.811	0.0	0.5	62
120 min Winter	18.615	0.0	0.6	116
180 min Winter	13.715	0.0	0.7	148
240 min Winter	10.995	0.0	0.7	186
360 min Winter	8.034	0.0	0.8	262

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
480 min Winter	-0.253	1.097	0.0	0.0	0.0	0.4	Flood Risk
600 min Winter	-0.316	1.034	0.0	0.0	0.0	0.4	O K
720 min Winter	-0.376	0.974	0.0	0.0	0.0	0.4	O K
960 min Winter	-0.485	0.865	0.0	0.0	0.0	0.4	O K
1440 min Winter	-0.654	0.696	0.0	0.0	0.0	0.3	O K
2160 min Winter	-0.835	0.515	0.0	0.0	0.0	0.2	O K
2880 min Winter	-0.957	0.393	0.0	0.0	0.0	0.2	O K
4320 min Winter	-1.088	0.262	0.0	0.0	0.0	0.1	O K
5760 min Winter	-1.171	0.179	0.0	0.0	0.0	0.1	O K
7200 min Winter	-1.233	0.117	0.0	0.0	0.0	0.0	O K
8640 min Winter	-1.280	0.070	0.0	0.0	0.0	0.0	O K
10080 min Winter	-1.302	0.048	0.0	0.0	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
480 min Winter	6.428	0.0	0.9	336
600 min Winter	5.404	0.0	0.9	408
720 min Winter	4.687	0.0	0.9	480
960 min Winter	3.743	0.0	1.0	618
1440 min Winter	2.723	0.0	1.1	890
2160 min Winter	1.979	0.0	1.2	1284
2880 min Winter	1.577	0.0	1.3	1676
4320 min Winter	1.143	0.0	1.4	2420
5760 min Winter	0.910	0.0	1.5	3112
7200 min Winter	0.762	0.0	1.5	3816
8640 min Winter	0.659	0.0	1.6	4496
10080 min Winter	0.583	0.0	1.6	5120

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 237 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.000	1.350	0.0	0.0	0.0	0.5	FLOOD
30 min Summer	0.000	1.350	0.0	0.0	0.0	0.7	FLOOD
60 min Summer	0.000	1.350	0.0	0.0	0.0	0.8	FLOOD
120 min Summer	0.000	1.350	0.0	0.0	0.0	1.0	FLOOD
180 min Summer	0.000	1.350	0.0	0.0	0.0	1.0	FLOOD
240 min Summer	0.000	1.350	0.0	0.0	0.0	1.0	FLOOD
360 min Summer	0.000	1.350	0.0	0.0	0.0	1.0	FLOOD
480 min Summer	0.000	1.350	0.0	0.0	0.0	1.0	FLOOD
600 min Summer	0.000	1.350	0.0	0.0	0.0	0.9	FLOOD
720 min Summer	0.000	1.350	0.0	0.0	0.0	0.9	FLOOD
960 min Summer	0.000	1.350	0.0	0.0	0.0	0.8	FLOOD
1440 min Summer	0.000	1.350	0.0	0.0	0.0	0.7	FLOOD
2160 min Summer	0.000	1.350	0.0	0.0	0.0	0.6	FLOOD
2880 min Summer	-0.124	1.226	0.0	0.0	0.0	0.5	Flood Risk
4320 min Summer	-0.406	0.944	0.0	0.0	0.0	0.4	O K
5760 min Summer	-0.596	0.754	0.0	0.0	0.0	0.3	O K
7200 min Summer	-0.734	0.616	0.0	0.0	0.0	0.3	O K
8640 min Summer	-0.843	0.507	0.0	0.0	0.0	0.2	O K
10080 min Summer	-0.929	0.421	0.0	0.0	0.0	0.2	O K
15 min Winter	0.000	1.350	0.0	0.0	0.0	0.5	FLOOD
30 min Winter	0.000	1.350	0.0	0.0	0.0	0.7	FLOOD
60 min Winter	0.000	1.350	0.0	0.0	0.0	0.8	FLOOD
120 min Winter	0.000	1.350	0.0	0.0	0.0	1.0	FLOOD
180 min Winter	0.000	1.350	0.0	0.0	0.0	1.0	FLOOD
240 min Winter	0.000	1.350	0.0	0.0	0.0	1.0	FLOOD
360 min Winter	0.000	1.350	0.0	0.0	0.0	1.0	FLOOD

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.153	0.0	0.6	26
30 min Summer	90.705	0.2	0.8	39
60 min Summer	56.713	0.3	0.9	66
120 min Summer	34.246	0.4	1.1	122
180 min Summer	25.149	0.5	1.3	180
240 min Summer	20.078	0.5	1.3	216
360 min Summer	14.585	0.4	1.5	276
480 min Summer	11.622	0.4	1.5	342
600 min Summer	9.738	0.4	1.6	410
720 min Summer	8.424	0.4	1.7	476
960 min Summer	6.697	0.3	1.8	610
1440 min Summer	4.839	0.2	1.9	870
2160 min Summer	3.490	0.0	2.1	1236
2880 min Summer	2.766	0.0	2.2	1592
4320 min Summer	1.989	0.0	2.4	2336
5760 min Summer	1.573	0.0	2.5	3064
7200 min Summer	1.311	0.0	2.6	3816
8640 min Summer	1.129	0.0	2.7	4512
10080 min Summer	0.994	0.0	2.8	5256
15 min Winter	138.153	0.0	0.6	27
30 min Winter	90.705	0.2	0.8	39
60 min Winter	56.713	0.3	0.9	66
120 min Winter	34.246	0.4	1.1	122
180 min Winter	25.149	0.5	1.3	176
240 min Winter	20.078	0.5	1.3	230
360 min Winter	14.585	0.4	1.5	286

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
480 min Winter	0.000	1.350	0.0	0.0	0.0	0.9	FLOOD
600 min Winter	0.000	1.350	0.0	0.0	0.0	0.9	FLOOD
720 min Winter	0.000	1.350	0.0	0.0	0.0	0.8	FLOOD
960 min Winter	0.000	1.350	0.0	0.0	0.0	0.8	FLOOD
1440 min Winter	0.000	1.350	0.0	0.0	0.0	0.6	FLOOD
2160 min Winter	-0.182	1.168	0.0	0.0	0.0	0.5	Flood Risk
2880 min Winter	-0.401	0.949	0.0	0.0	0.0	0.4	O K
4320 min Winter	-0.683	0.667	0.0	0.0	0.0	0.3	O K
5760 min Winter	-0.862	0.488	0.0	0.0	0.0	0.2	O K
7200 min Winter	-0.981	0.369	0.0	0.0	0.0	0.2	O K
8640 min Winter	-1.058	0.292	0.0	0.0	0.0	0.1	O K
10080 min Winter	-1.116	0.234	0.0	0.0	0.0	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
480 min Winter	11.622	0.4	1.5	362
600 min Winter	9.738	0.4	1.6	436
720 min Winter	8.424	0.3	1.7	510
960 min Winter	6.697	0.2	1.8	648
1440 min Winter	4.839	0.1	1.9	904
2160 min Winter	3.490	0.0	2.1	1276
2880 min Winter	2.766	0.0	2.2	1648
4320 min Winter	1.989	0.0	2.4	2392
5760 min Winter	1.573	0.0	2.5	3168
7200 min Winter	1.311	0.0	2.6	3904
8640 min Winter	1.129	0.0	2.7	4664
10080 min Winter	0.994	0.0	2.8	5344

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.150

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	5	0.383	5	10	0.383	10	15	0.383

Model Details

Storage is Online Cover Level (m) 83.700

Infiltration Basin Structure

Invert Level (m) 81.700 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.03600 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.03600

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	314.0	2.000	1017.0

Pump Outflow Control

Invert Level (m) 81.700

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.0000	0.700	0.0000	1.300	0.0000	1.900	0.0000	2.500	0.0000
0.200	0.0000	0.800	0.0000	1.400	0.0000	2.000	0.0000	2.600	0.0000
0.300	0.0000	0.900	0.0000	1.500	0.0000	2.100	0.0000	2.700	0.0000
0.400	0.0000	1.000	0.0000	1.600	0.0000	2.200	0.0000	2.800	0.0000
0.500	0.0000	1.100	0.0000	1.700	0.0000	2.300	0.0000	2.900	0.0000
0.600	0.0000	1.200	0.0000	1.800	0.0000	2.400	0.0000	3.000	0.0000

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 1304 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	82.592	0.892	4.5	0.0	4.5	392.0	O K
30 min Summer	82.790	1.090	5.2	0.0	5.2	512.8	O K
60 min Summer	82.970	1.270	5.9	0.0	5.9	635.7	O K
120 min Summer	83.130	1.430	6.5	0.0	6.5	755.1	O K
180 min Summer	83.210	1.510	6.8	0.0	6.8	818.2	O K
240 min Summer	83.258	1.558	7.0	0.0	7.0	857.1	O K
360 min Summer	83.315	1.615	7.2	0.0	7.2	904.8	O K
480 min Summer	83.347	1.647	7.3	0.0	7.3	932.2	O K
600 min Summer	83.364	1.664	7.4	0.0	7.4	947.1	O K
720 min Summer	83.372	1.672	7.4	0.0	7.4	953.9	O K
960 min Summer	83.371	1.671	7.4	0.0	7.4	953.0	O K
1440 min Summer	83.357	1.657	7.3	0.0	7.3	941.2	O K
2160 min Summer	83.327	1.627	7.2	0.0	7.2	915.4	O K
2880 min Summer	83.290	1.590	7.1	0.0	7.1	883.8	O K
4320 min Summer	83.208	1.508	6.8	0.0	6.8	816.3	O K
5760 min Summer	83.127	1.427	6.5	0.0	6.5	752.1	O K
7200 min Summer	83.052	1.352	6.2	0.0	6.2	695.3	O K
8640 min Summer	82.984	1.284	5.9	0.0	5.9	645.7	O K
10080 min Summer	82.922	1.222	5.7	0.0	5.7	601.6	O K
15 min Winter	82.592	0.892	4.5	0.0	4.5	392.1	O K
30 min Winter	82.790	1.090	5.2	0.0	5.2	513.0	O K
60 min Winter	82.971	1.271	5.9	0.0	5.9	636.1	O K
120 min Winter	83.132	1.432	6.5	0.0	6.5	755.9	O K
180 min Winter	83.212	1.512	6.8	0.0	6.8	819.6	O K
240 min Winter	83.260	1.560	7.0	0.0	7.0	858.9	O K
360 min Winter	83.318	1.618	7.2	0.0	7.2	907.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.153	0.0	295.9	30
30 min Summer	90.705	0.0	349.5	44
60 min Summer	56.713	0.0	628.5	74
120 min Summer	34.246	0.0	718.3	132
180 min Summer	25.149	0.0	767.8	192
240 min Summer	20.078	0.0	800.2	250
360 min Summer	14.585	0.0	844.0	368
480 min Summer	11.622	0.0	873.3	486
600 min Summer	9.738	0.0	893.6	604
720 min Summer	8.424	0.0	907.9	722
960 min Summer	6.697	0.0	924.1	918
1440 min Summer	4.839	0.0	925.5	1142
2160 min Summer	3.490	0.0	1440.9	1524
2880 min Summer	2.766	0.0	1482.0	1940
4320 min Summer	1.989	0.0	1468.1	2768
5760 min Summer	1.573	0.0	1736.8	3584
7200 min Summer	1.311	0.0	1808.6	4400
8640 min Summer	1.129	0.0	1868.8	5192
10080 min Summer	0.994	0.0	1920.8	5952
15 min Winter	138.153	0.0	295.9	29
30 min Winter	90.705	0.0	349.5	44
60 min Winter	56.713	0.0	628.5	72
120 min Winter	34.246	0.0	718.3	130
180 min Winter	25.149	0.0	767.7	188
240 min Winter	20.078	0.0	800.1	246
360 min Winter	14.585	0.0	843.9	360

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
480 min Winter	83.351	1.651	7.3	0.0	7.3	936.0	O K
600 min Winter	83.370	1.670	7.4	0.0	7.4	952.1	O K
720 min Winter	83.379	1.679	7.4	0.0	7.4	960.3	O K
960 min Winter	83.381	1.681	7.4	0.0	7.4	962.3	O K
1440 min Winter	83.359	1.659	7.3	0.0	7.3	942.5	O K
2160 min Winter	83.320	1.620	7.2	0.0	7.2	909.2	O K
2880 min Winter	83.270	1.570	7.0	0.0	7.0	866.9	O K
4320 min Winter	83.160	1.460	6.6	0.0	6.6	778.1	O K
5760 min Winter	83.053	1.353	6.2	0.0	6.2	696.2	O K
7200 min Winter	82.954	1.254	5.8	0.0	5.8	624.2	O K
8640 min Winter	82.865	1.165	5.5	0.0	5.5	562.7	O K
10080 min Winter	82.785	1.085	5.2	0.0	5.2	509.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
480 min Winter	11.622	0.0	873.1	476
600 min Winter	9.738	0.0	893.4	590
720 min Winter	8.424	0.0	907.6	702
960 min Winter	6.697	0.0	923.7	918
1440 min Winter	4.839	0.0	925.0	1164
2160 min Winter	3.490	0.0	1440.8	1620
2880 min Winter	2.766	0.0	1481.9	2080
4320 min Winter	1.989	0.0	1468.0	2952
5760 min Winter	1.573	0.0	1736.8	3816
7200 min Winter	1.311	0.0	1808.6	4624
8640 min Winter	1.129	0.0	1868.8	5456
10080 min Winter	0.994	0.0	1920.7	6256

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