

# LAND EAST OF GLOUCESTER ROAD, GLOUCESTER

## Flood Risk and Drainage Statement

AAC5655

2

25 September 2020

## REPORT

### Document status

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Prepared by:

#### RPS Consulting Services Limited

[REDACTED]  
Assistant Hydrologist

Salisbury House, 2a Tettenhall Road  
Wolverhampton, West Midlands WV1 4SA

Prepared for:

#### Tritax Symmetry

[REDACTED]  
Development Director

Grange Park Court, Roman Way,  
Northampton, NN4 5EA

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# 1 INTRODUCTION

RPS Consulting Services Limited has been commissioned to undertake a Flood Risk Statement on behalf of Tritax Symmetry for a proposed commercial development at Land to the East of Gloucester Road, Haresfield, Gloucester.

The proposal is for a commercial development located to the east of Gloucester Road, comprising logistics floor space divided across approximately 2 units. The site is being promoted through the Stroud District Local Plan, to assist in meeting Gloucestershire's regional employment needs.

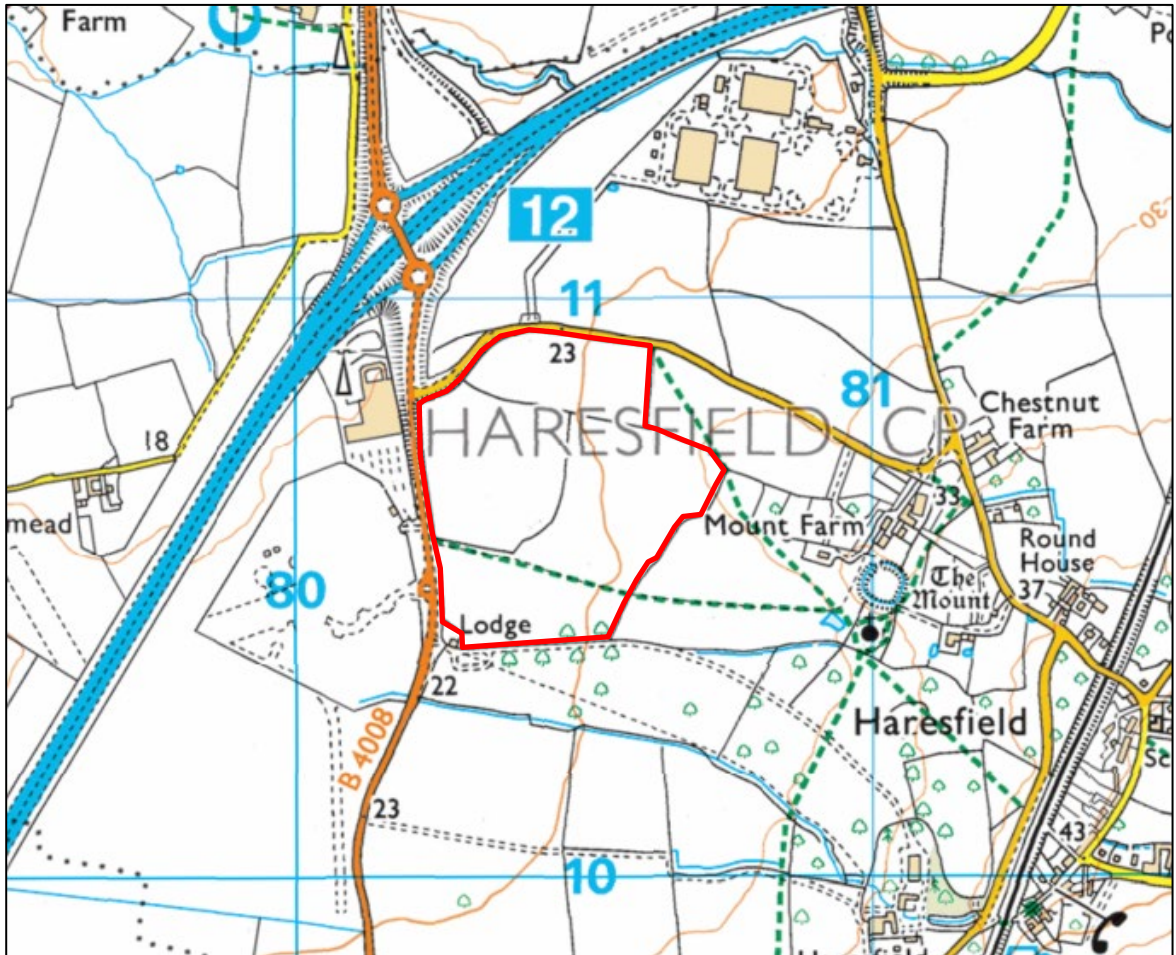
The Flood Map for Planning demonstrates that the site is entirely located within Flood Zone 1. Land in Flood Zone 1 is assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%), the lowest classification of fluvial flood risk.

The Drainage Statement indicates that the site can sustainably manage surface water arising from the development up to the 1 in 100 year +40% climate change storm event. Suitable SuDS features should be incorporated within the site designs to attenuate surface water prior to discharging from the site at the greenfield runoff rate.

## 2 SITE DETAILS

### 2.1 Site Overview

The Application Site is shown in Figure 3.1 below. The site is located to the East of Gloucester Road, Haresfield, Gloucester (National Grid Reference 380457, 210686) and covers an area of approximately 20.67 hectares (ha). The consultees associated with this location are provided in Table 3.1.



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Approximate site boundary indicated in red, for location purposes only.

**Figure 2.1: Site Location Plan**

**Table 2.1: Site Specific Data and Consultees**

<b>OS NGR</b>	SO80451068
<b>Local Planning Authority</b>	Stroud District Council (SDC)
<b>Lead Local Flood Authority</b>	Gloucestershire County Council (GCC)
<b>Sewer Utility Company</b>	Severn Trent Water (STW)

## 2.2 Site Description and Surrounding Area

The site is located approximately 8.5km south of Gloucester city centre, comprising a parcel of land of irregular shape. The site covers an area of approximately 20.67 ha. The land generally falls towards the north west, from a level of approximately 30.50m Above Ordnance Datum (AOD), to approximately 19.80m AOD. The topographical survey is included within Appendix A for reference.

The site is presently greenfield land, currently used for agricultural purposes. The northern boundary is delineated by Stonehouse, whereas Bath Road/Gloucester Road is located adjacent the western boundary of the site. Further agricultural land is located beyond the eastern and southern boundaries of the proposed development site.

## 2.3 Development Proposals

The proposal is for a commercial development located to the east of Gloucester Road, comprising logistics floor space divided across approximately 2 units. The site is being promoted through the Stroud District Local Plan, to assist in meeting Gloucestershire's regional employment needs.

The site masterplan is provided in Appendix B for reference.

## 3 SCOPING STUDY

### 3.1 Stroud District Council Strategic Flood Risk Assessment, November 2019

This Strategic Flood Risk Assessment (SFRA) undertakes a Level 2 assessment of the site options identified for potential allocation with the emerging Stroud Local Plan. The SFRA considers all sources of flooding within the study area including fluvial, surface water, groundwater, sewers, canals and reservoirs. It provides an update to the policy and flood risk information provided in the existing Stroud Level 1 SFRA (2008) and builds upon the Level 2 SFRA for Stroud originally published in March 2012.

Stroud has experienced several notable flood events, including the January 1939, March 1947, July 1968, December 1981, January 1990, December 2000 and summer 2007 events. The fluvial flood risk within the Stroud District is high, due to the presence of numerous watercourses, many with steep catchments which respond rapidly to rainfall. The highest surface water flood risk in Stroud District is associated with the steep river catchments of The Cam and River Frome.

The areas of highest groundwater flood risk within the district broadly correspond with the locations of permeable superficial geology deposits, and surface aquifers. Groundwater flooding has been recorded across the Stroud District by GCC. There are records of groundwater flooding in Little Haresford (December 2017) and Standish (March 2018), located approximately 1.5km and 2.4km south of the proposed development site, respectively. The Risk of Flooding from Groundwater Map illustrates that the whole site is located within an area with less than 25% change of groundwater emergence.

Sustainable Drainage Systems (SuDS) can be integrated into the design of all new development within Stroud District. The effectiveness of SuDS within a site is defined by site characteristics including (but not limited to) topography, geology, soil permeability, water table, existing water flows across the site, land ownership and extent of site coverage necessary to effectively manage surface water runoff and drainage.

### 3.2 Gloucestershire County Council Local Flood Risk Management Strategy, Summer 2014

This Local Flood Risk Management Strategy (LFRMS) was prepared by GCC, which sets out the vision and framework for managing flood risk, identifies the most vulnerable communities across Gloucestershire, and identifies the range of measures that will be taken in partnership with others to manage flood risk. The LFRMS is an important tool to help individuals, communities, businesses and authorities understand and manage flood risk within the county.

Gloucestershire has a long history of flooding. In the summer 2007 Gloucestershire experienced one of the most significant flood incidents seen in the UK, which resulted in 5000 homes and businesses flooded. Significant flooding also occurred in both November and December 2012, where an estimated 125-150 properties suffered from flooding.

The LFRMS sets out strategic objectives to help manage local flood risk across Gloucestershire:

- Improve our understanding of flood risk.
- Put in place plans to manage these risks.
- Avoid inappropriate development and ensure that new development does not increase flooding elsewhere.
- Increase public awareness of flooding and encourage communities to take action.
- Ensure close partnership working and coordination with other Risk Management Authorities and local communities.
- Support response to, and recovery from, flooding incidents.

### 3.3 Gloucestershire SuDS Design and Maintenance Guide, November 2015

This document was prepared by GCC to provide guidance to developers, designers, engineers and other professionals on the council's requirements for the design of SuDS in Gloucestershire. It sets out the planning, design and maintenance requirements for the delivery of attractive and high quality SuDS schemes that would offer multiple benefits to the environment and communities and will ensure a smooth and satisfactory SuDS approval process.

Some of GCC's requirements for SuDS are summarised as follows:

- To minimise the impact of the development on the environment, surface water discharges from the site should not exceed the current runoff rate from the pre-developed site.
- The assessment must make due allowance to the effects of climate change over the lifetime of the development.
- Evidence that the hierarchal approach has been applied to the discharge of surface water must be provided.
- Developers must demonstrate they have considered the possibility that their drainage design might fail even if the system is designed for 100 year storms with allowance for climate change.

### 3.4 Consultation with Gloucestershire County Council

GCC were consulted on 26<sup>th</sup> June 2020 regarding the proposed development, and the response is provided in Appendix C for reference. The information provided by GCC is summarised below:

- The LLFA has a report of highway flooding on Stonehouse to the north of the site in 2007 and a report of property flooding in 2012 from surface water to the southwest. There is also a report of the M5 Junction 12 southbound slip road and carriageway flooding in 2007.
- The drainage strategy should comply with the principles of SuDS hierarchy for surface water.
- Where necessary, infiltration tests should be completed to BRE Digest 365 standard and the results provided.
- There should be no surface water flooding on site for rainfall events up to and including the 1 in 30 year event and no internal flooding to properties up to the 1 in 100 year +40% Climate Change event.
- Discharging into an ordinary watercourse may require Land Drainage Consent from Stroud District Council.
- When developing next to a watercourse, it is recommended a 5-8m strip of land be kept free for maintenance purposes.
- Any attenuation features should be shown including calculations for stored volumes and discharge rates.
- For greenfield developments, the peak discharge rate up to the 1 in 100 year rainfall event +40% Climate Change should never exceed the peak greenfield runoff rate for the same event.
- The drainage strategy should not result in any deterioration in water quality and the use of SuDS should improve water quality wherever possible.

### 3.5 Consultation with Environment Agency

The EA were consulted on 6<sup>th</sup> July 2020 regarding the proposed development, and the response is provided in Appendix D for reference. They confirm that the site is in an area located within Flood Zone 1, as shown on the Flood Map for Planning.



## 4 FLOOD RISK STATEMENT

### 4.1 Introduction

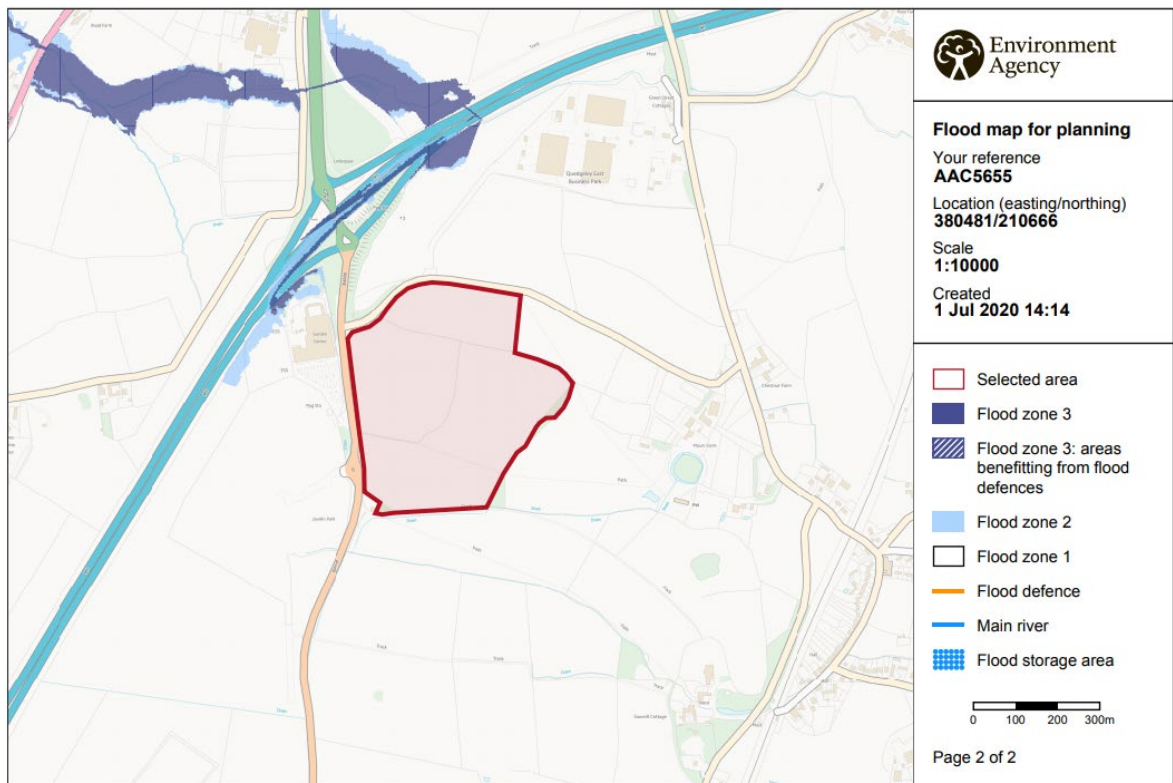
Following the scoping exercise, the potential flood risks to the proposed development site have been assessed in greater detail.

### 4.2 Fluvial

The Environment Agency (EA) is responsible for managing the risk of flooding from main rivers, reservoirs, estuaries and the sea and provides an online information service through the Flood Map for Planning hosted on the 'GOV.UK' website (<https://flood-map-for-planning.service.gov.uk/>). This data is not intended to provide detailed flood information for individual properties, but the information can be used as part of a flood risk assessment to inform a planning application. An extract of the Flood Map for Planning obtained from the 'GOV.UK' website is provided below in Figure 4.1.

The map demonstrates that the site is entirely located within Flood Zone 1. Land in Flood Zone 1 is assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%), the lowest classification of fluvial flood risk.

The nearest watercourse is a drainage ditch located adjacent the southern boundary of the site; it is not considered that this poses a considerable risk of fluvial flooding. Consequently, the site is not considered to be at risk from fluvial flooding.



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*Approximate site boundary indicated in red, for location purposes only.*

**Figure 4.1: EA Flood Map for Planning (accessed 01.07.2020)**

### 4.3 Pluvial, Surface Runoff and Ponding

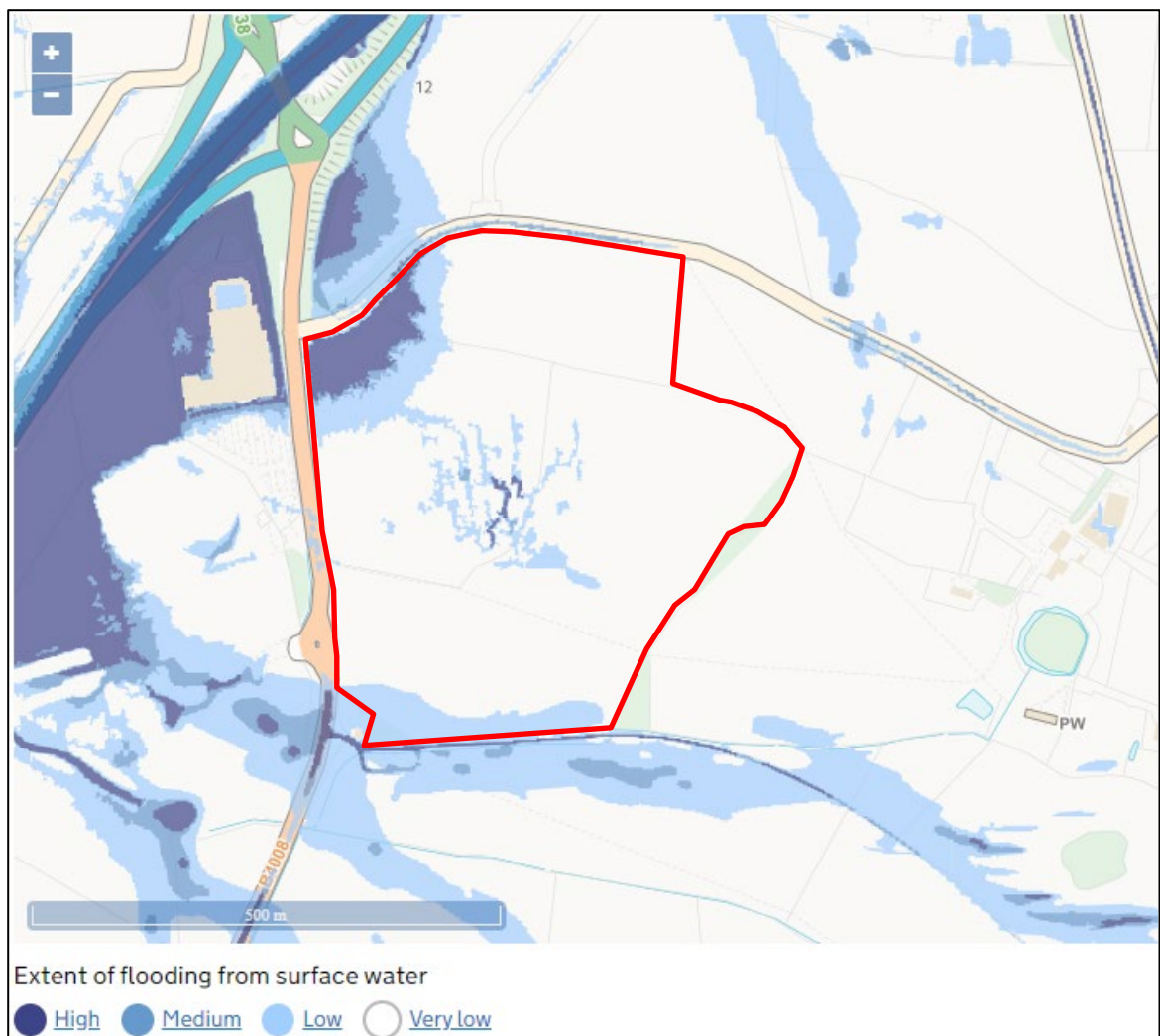
Pluvial flooding is defined as flooding which results from rainfall-generated overland flow, before the runoff enters any watercourse or sewer. It is usually associated with high intensity rainfall events (typically >30mm/h) but can also occur with lower intensity rainfall or melting snow where the ground is saturated, frozen, developed or otherwise has low permeability resulting in overland flow and

ponding in depressions in the topography. Urban pluvial flooding arises from high intensity ‘extreme’ rainfall events. In such situations underground sewerage and drainage systems and surface watercourses may be completely overwhelmed.

Surface water flood risk is defined by the EA as:

- ‘Very low’ risk of surface water flooding; land assessed as having less than 1 in 1,000 (0.1%) chance of flooding in any given year.
- ‘Low’ risk of surface water flooding; land assessed as having between 1 in 100 (1%) and 1 in 1,000 (0.1%) chance of flooding in any given year.
- ‘Medium’ risk of surface water flooding; land assessed as having between 1 in 30 (3.3%) and 1 in 100 (1%) chance of flooding in any given year.
- ‘High’ risk of surface water flooding; land assessed as having greater than 1 in 30 (3.3%) chance of flooding in any given year.

As illustrated within Figure 4.2 below, most of the application site is assessed as being at ‘very low’ risk of surface water flooding. There is an area in the north west corner of the site that is potentially at ‘high’ risk of surface water flooding. The land adjacent the southern boundary of the site is at ‘low’ risk of surface water flooding.



*Approximate site boundary indicated in red, for location purposes only.*

**Figure 4.2: EA Flood Map for Surface Water (accessed 01.07.2020)**

The ‘low’ risk of surface water flooding along the southern boundary of the site is associated with a surface water flow route that heads in a westerly direction and crosses Gloucester Road. No

development is currently proposed to the south of the estate road on the masterplan in Appendix B, therefore this surface water flow route is not a risk to the proposed development.

There is an area at potential 'high' risk of surface water flooding in the northwest corner of the site. This is most likely due to surface water from the site collecting against the embankments of the B4008 and Stonehouse, as these highways are raised in comparison to the site. The modelling indicates that most of the surface water that contributes to this potential flood risk originates within the site boundary. Surface water from the B4008 and Stonehouse will be intercepted by the highway drainage system. Therefore, the introduction of a surface water drainage system once the site is developed will ensure that surface water originating within the site will be fully managed, such that it will not pose a flood risk to existing or proposed property. This is further explained in section 5.4.

## **4.4 Groundwater**

Groundwater flooding is defined as flooding caused by the emergence of water originating from underground. This water may emerge from either point or diffuse locations. Groundwater flooding is a significant but localised issue that has attracted an increasing amount of public concern in recent years. Unlike flooding from rivers and the sea, groundwater flooding does not pose a significant risk to life. It is however associated with significant damage to property, with some types of groundwater flooding persisting over many weeks.

A Phase 1 Preliminary Geo-environmental Risk Assessment was undertaken in June 2020 by RPS, an extract from the report is provided in Appendix E for reference. The site is underlain by Blue Lias Formation and Charmouth Mudstone Formation. According to Groundwater vulnerability mapping, the site is in a zone of medium vulnerability associated with groundwater flow through poorly connected rock fractures.

The Risk of Flooding from Groundwater Map provided within the SFRA, illustrates that the whole site is located within an area with less than 25% change of groundwater emergence. Therefore, it is not considered that groundwater flooding poses a considerable risk to the proposed development site. It is recommended that groundwater monitoring is undertaken prior to the site being developed, to get a better understanding of the groundwater regime.

## **4.5 Reservoir**

An area is considered at risk from reservoir flooding if peoples' lives could be threatened by an uncontrolled release of water from a reservoir. If a location is at risk, flooding from reservoirs is extremely unlikely. There has been no loss of life in the UK from reservoir flooding since 1925.

Long term flood risk information is hosted on the 'GOV.UK' website (<https://flood-warninginformationsservice.gov.uk/long-term-flood-risk/map>). The assessment provides mapping to illustrate the probability that a location will flood and the possible causes of flooding including flood risk from reservoirs.

The Flood Risk from Reservoirs Map in Figure 4.3 demonstrates that the whole site is outside of the maximum flood extent. No major reservoirs are located within close vicinity of the site. Therefore, reservoir flooding will not pose a risk to the proposed development site.



*Approximate site boundary indicated in red, for location purposes only.*

**Figure 4.3:EA Flood Map, Flood risk from Reservoirs (accessed 01.07.2020)**

## 5 DRAINAGE STATEMENT

### 5.1 Introduction

To demonstrate that all forms of flooding have been considered a Foul and Surface Water Drainage Statement has been developed. The aim of including this strategy is so that it can easily be seen that the Proposed Development will not adversely affect the surface water regime in the area and that overall the current situation will be improved.

### 5.2 Existing Surface Water Drainage

Sewer records from STW are provided in Appendix F for reference, indicating that there are no public surface water sewers located within the boundary of the site or within the vicinity of the site.

The greenfield nature of the site means that surface water will slowly soak into the ground (infiltrate), be intercepted by vegetation or run off by way of overland flow, according to the soil characteristics and following the topography of the site. Greenfield runoff rates for the site have been calculated by way of Interim Code of Practice for Sustainable Drainage Systems (ICP SUDS). This implements a pro rata IOH124 methodology, for sites below 50ha in size. The calculation has been included for reference within Appendix G and outputs are summarised within Table 5.1, below, based upon a hypothetical 1ha area.

Return Period	Greenfield Runoff Rate (l/s)
Q1	3.0
QBar	3.6
Q30	7.1
Q100	9.3

Table 5.1: Greenfield Runoff (for hypothetical 1ha area)

### 5.3 Existing Foul Water Drainage

Sewer records from STW are provided in Appendix F for reference, indicating that a foul rising main transects the northwest corner of the proposed development site. There are further STW assets located within the vicinity of the site, most notably a combined sewer to the northeast of the site and two pumping stations located to the west.

### 5.4 Proposed Surface Water Drainage

Under the terms of Section 3 of Approved Document H3 of the Building Regulations 2010 (2015 edition), soakaways should be utilised as the primary means of surface water disposal. If infiltration testing undertaken in accordance with BRE DG 365 (2016) provides an unfavourable infiltration rate across the site or contaminated ground is present within the site, other methods of sustainable drainage should be considered. A surface water connection to an existing watercourse should be considered prior to a connection into the public sewerage system.

A Phase 1 Preliminary Geo-environmental Risk Assessment was undertaken in June 2020 by RPS, an extract from the report is provided within Appendix E for reference. The site is underlain by Blue Lias Formation and Charmouth Mudstone Formation. Mudstone generally has a poor infiltration rate; therefore it is likely that soakaways will not be suitable for the disposal of surface water from the site. Consequently, the proposed surface water drainage system will need to consider the use of

local attenuation and treatment with a positive outfall. At the detailed design stage, it would be beneficial to carry out soil permeability testing to inform SuDS design.

Preliminary calculations have been undertaken based on the current site layout. The MicroDrainage calculations are provided within Appendix H for reference and the parameters are outlined in Table 5.2 below.

Surface water drainage requirements	Units	Value
<b>Site information</b>		
Total Site Area	(ha)	20.667
Developable Area	(ha)	13.341
Impermeable Area (assuming 90% impermeable)	(ha)	12.007
<b>Runoff rates</b>		
QBAR Greenfield Runoff Rate	(l/s/ha)	3.6
Restricted runoff rate for site	(l/s)	43.2
<b>Surface water storage requirements</b>		
Storage volume requirement (1:100+40% increase for climate change)	(m <sup>3</sup> )	9160
Storage area requirement (estimated) 1.5m deep basin with 1:3 banks	(m <sup>2</sup> )	9500

**Table 5.2: Breakdown of Surface Water Drainage Calculations**

At the detailed design stage, it is anticipated that surface water will be captured within a gravity sewer system and attenuated prior to discharge within SuDS features, with a preference for above ground storage. Flows should be restricted to the greenfield runoff rate, ensuring the peak discharge rate up to the 1 in 100 year +40% Climate Change event does not exceed the peak greenfield runoff rate for the same event, as outlined within the Gloucestershire SuDS Design & Maintenance Guide.

The most appropriate location for SuDS features within the site would be in the northwest and southwest corners of the site, where topography is at its lowest, as illustrated by the topographic survey in Appendix A. The surface water attenuation should be suitably sized to accommodate a 1 in 100 year +40% Climate Change storm event. This will ensure that surface water arising from the development is sustainably managed such that it does not pose a flood risk, either to existing or proposed development.

Surface water from the site should be discharged into a nearby watercourse or drainage ditch. Further investigation and surveying should be undertaken at the detailed design stage to confirm the most suitable outfall point.

No existing surface water drainage has been identified within the boundary of the site. Should any drainage features be located serving off site areas, it may be necessary that these are diverted or incorporated within the on-site drainage proposals.

Any proposed SuDS features should provide an easily managed landscape structure for temporary storage of water and to trap and treat pollutants prior to discharge. The location and design should also create opportunities for ecological and amenity benefits in the context of the development, subject to detailed landscape proposals. The designs should recognise the requirements of the Gloucestershire SuDS Design & Maintenance Guide.

## 5.5 Proposed Foul Water Drainage

Considering the location of the nearest public sewers, it is likely that foul water will have to be conveyed by a gravity sewer network to a new foul pumping station located within the site. A rising main will then convey the foul flows from the site to the nearest suitable connection point within the existing STW sewer network.

A Developer Enquiry was submitted to STW for the site, their response is provided in Appendix F for reference. STW confirm that there may be a need to undertake hydraulic modelling to determine

whether Bath Road and RAF Quedgeley pumping stations require upgrading to increase capacity in the area.

Once a layout is fixed for the site, further liaison should be undertaken with STW in order to confirm whether the local network requires reinforcement works to accommodate the proposed development.

### **5.6 Maintenance and Adoption**

A foul water connection into the existing network will be subject to the successful submission of a Section 106 agreement under the Water Industry Act and approval from STW.

Subject to detailed engineering designs, it is likely that both foul and surface water drainage systems within the development will be adopted by STW.

A specialist management company could be identified at the detailed design stage and appointed to maintain the proposed SuDS features for the lifetime of the development. The SuDS features should be maintained in line with the guidance provided in The SuDS Manual (C753).

## 6 CONCLUSIONS AND RECOMMENDATIONS

The proposed development at Land east of Gloucester Road, Gloucester has been assessed with regards to flood risk. It is not considered that flooding poses a risk to the proposed development of the site subject to and implementation of the recommended measures and drainage statement.

### 6.1 Review of Flood Risk

Based on the current proposals and masterplan;

- The proposed development will not be affected by current or future fluvial flooding;
- The development will not increase flood risk elsewhere;
- Multiple sources of flooding have also been assessed and it has been found that there will be no increase in risk of flooding from land, groundwater or sewers as a result of this development;
- There are no anticipated negative impacts associated with the proposed development;
- Positive social, economic and environmental impacts will result from the proposed development provided the layout and design consider the recommendations.

### 6.2 Review of Drainage Statement

Based on the current proposals and masterplan;

- Under the terms of Section H of the Building Regulations 2010, as the underlying ground conditions indicate that infiltration drainage may be unsuitable, soakaway testing should be undertaken to confirm this.
- The on site drainage solution should be suitable to attenuate flows up to and including the 1 in 100 year + 40% rainfall event.
- Surface water from the site should be discharged into a nearby watercourse or drainage ditch. Further investigation and surveying should be undertaken at the detailed design stage to confirm the most suitable outfall point.
- The onsite sewers are likely to be adopted by Severn Trent Water.
- A foul water connection to the existing public sewerage system will be subject to Section 106 approval from Severn Trent Water.
- A specialist management company could be identified at the detailed design stage and appointed to maintain the SuDS features for the lifetime of the development.



## Appendix A – Topographic Survey



## Appendix B – Masterplan



**Schedule of Accommodation**  
All areas are square feet gross internal

Unit	B8	Offices	Total	Parking	Net Site Area
01	522,500	25,000	547,500	424no. cars	23.00 acres
02	250,000	10,000	260,000	199no. cars	12.20 acres
<b>Total</b>			<b>807,500 sq.ft.</b>		<b>35.20 acres</b>
<b>Gross site area (within red line)</b>					<b>51.13 acres</b>

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**project**  
Symmetry Park  
Junction 12, M5  
Gloucester

**drawing**

**Illustrative Masterplan**

scale 1:1000 @ A0 drawn up

checked alps date 18/09/20

no



**Schedule of Accommodation**  
All areas are square feet gross internal

Unit	B8	Offices	Total	Parking	Net Site Area
01	522,500	25,000	547,500	424no. cars	24.95 acres
02	250,000	10,000	260,000	199no. cars	12.20 acres
<b>Total</b>			<b>807,500 sq.ft.</b>		<b>37.15 acres</b>
<b>Gross site area (within red line)</b>					<b>51.13 acres</b>

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## Appendix C – Correspondence with Gloucestershire County Council

In response to the request for pre-application advice on surface water drainage on the above application the Lead Local Flood Authority (LLFA) can advise as follows. It should be noted that the LLFA is a statutory consultee on major development only and the applicant might want to seek advice from Stroud District Council should the development not meet our criteria.

A surface water drainage strategy is required for all applications and for sites greater than 1 ha or those within the Environment Agency's flood zones 2 or 3, a site specific flood risk assessment (FRA) is also required. Guidance on FRAs can be found at: <https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications>. The Flood Map for Planning can be seen here: <https://flood-map-for-planning.service.gov.uk/>

The Risk of Flooding from Surface Water (RoFfSW) maps from the Environment Agency show there are areas of the site at high risk of surface water flooding. These maps can be found here: <https://flood-warning-information.service.gov.uk/long-term-flood-risk/map>. The LLFA has a report of highway flooding to the north of the site, on the road marked as Stonehouse on the location plan, in 2007 and a report of property flooding in 2012 from surface water to the southwest of the site. The LLFA also has a report of the M5 Junction 12 southbound slip road and carriageway flooding in 2007.

The drainage strategy should comply with the principles of Sustainable Drainage Systems (SuDS) hierarchy for surface water. In doing so, consideration should be given first to infiltration, then discharge to a watercourse, then connecting to a public surface water sewer and finally connecting to a public combined sewer (with the necessary permissions from the relevant water company) if there are no other viable options. Where connections require crossing of third party land, agreement in principle from the relevant party should be included.

Where necessary, infiltration tests should be completed to BRE Digest 365 standard and the results provided. Please note that discharging to an ordinary watercourse (which includes ditches) may require Land Drainage Consent from Stroud District Council. If the strategy is to discharge into a watercourse then there would need to be proof that the site will still be able to drain or there is sufficient storage onsite for when the watercourse is in high flow or when the watercourse is in flood. If the site doesn't currently drain into the watercourse then we would need to provide proof that the risk of flooding is not increased as a result of increasing the discharge into it.

There should be no surface water flooding on site for rainfall events up to and including the 1 in 30 year event and no internal flooding to properties (including basements) up to the 1 in 100 year event (plus 40% for climate change). Development should not increase flood risk outside of the site. Exceedance flow routes for events greater than the 1 in 100 year storm should be identified and

should avoid properties including gardens. When developing next to a watercourse, it is recommended a 5-8m strip of land be kept free for maintenance purposes.

Any attenuation features should be shown including calculations for stored volumes and discharge rates. For greenfield developments, the peak discharge rate up to the 1 in 100 year rainfall event (plus 40% for climate change) should never exceed the peak greenfield runoff rate for the same event. For brownfield developments, the peak discharge rate from the development up to the 1 in 100 year rainfall event (plus 40%) should be as close as is reasonably practicable to the greenfield runoff rate for the same event. If this is not feasible then Gloucestershire County Council will accept a 40% reduction over the pre development discharge rate. It should never exceed the pre-development discharge rate for the same event.

For greenfield developments, the runoff volume up to the 1 in 100 year, 6 hour rainfall event (plus 40% climate change) should not exceed the greenfield runoff volume for the same event. For brownfield sites the runoff volume up to the 1 in 100 year, 6 hour event (plus 40% climate change) should be constrained to a value as close as is reasonably practicable to the Greenfield runoff volume. Where this isn't practicable, the runoff volume should be reduced by 40% of the existing volume and should never exceed it.

The strategy should not result in any deterioration in water quality and the use of SuDS should improve water quality wherever possible. Information provided by the SuDS manual, CIRIA C753, should be considered when designing the SuDS system.

For more information and to access our "Standing Advice and Development Guidance" and "Gloucestershire SuDS Design and Maintenance Guide" documents please visit our website: <http://www.gloucestershire.gov.uk/planning-and-environment/flood-risk-management/surface-water-drainage-and-major-planning-applications/>.



## Appendix D – Correspondence with the Environment Agency

**From:** [Enquiries\\_Westmids](#)  
**To:** [REDACTED]  
**Subject:** Our Ref. 176150 - Flood Information Request - Land off Bath Road, Haresfield, Gloucester, GL10 3DP  
**Date:** 06 July 2020 15:01:56  
**Attachments:** [image001.png](#)  
[image002.png](#)  
[Flood Map for Planning \(Rivers and Sea\).pdf](#)

**CAUTION:** This email originated from outside of RPS.

Dear [REDACTED]

**Enquiry regarding Flood Map for Planning (Rivers and Sea) Information for Land off Bath Road, Haresfield, Gloucester, GL10 3DP**

Thank you for your enquiry which was received on 25 June.

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004.

The information on Flood Zones in the area relating to this address is as follows:

**The property is in an area located within Flood Zone 1 shown on our Flood Map for Planning (Rivers and Sea).**

*Note - This information relates to the area that the above named property is in and is not specific to the property itself as it is influenced by factors such as the height of door steps, air bricks or the height of surrounding walls. We do not have access to this information and is not currently used in our flood modelling.*

Flood Zone definitions can be found at [www.gov.uk/guidance/flood-risk-and-coastal-change#Table-1-Flood-Zones](http://www.gov.uk/guidance/flood-risk-and-coastal-change#Table-1-Flood-Zones)

Please find attached a copy of the Flood Map for Planning (Rivers and Sea) for the area relating to your address.

More information can be found on the website at: <https://flood-map-for-planning.service.gov.uk/> You can draw your development extent and the service then provides details on what level of Flood Risk Assessment you would require and the reasons why.

**Abstract**

Name	Product 1
Description	Flood Map for Planning (Rivers and Sea) GL10 3DP
Licence	<a href="#">Open Government Licence</a>
Information Warning - OS background mapping	<i>The mapping of features provided as a background in this product is © Ordnance Survey. It is provided to give context to this product. The Open Government Licence does not apply to this background mapping. You are granted a non-exclusive, royalty free, revocable licence solely to view the Licensed Data for non-commercial purposes for the period during which the</i>

	<i>Environment Agency makes it available. You are not permitted to copy, sub-license, distribute, sell or otherwise make available the Licensed Data to third parties in any form. Third party rights to enforce the terms of this licence shall be reserved to OS.</i>
Attribution	Contains Environment Agency information © Environment Agency and/or database rights. Contains Ordnance Survey data © Crown copyright 2017 Ordnance Survey 100024198.

### Data Available Online

Many of our flood datasets are available online:

- Flood Map For Planning ([Flood Zone 2](#), [Flood Zone 3](#), [Flood Storage Areas](#), [Flood Defences](#), [Areas Benefiting from Defences](#))
- [Risk of Flooding from Rivers and Sea](#)
- [Historic Flood Map](#)
- [Current Flood Warnings](#)

Further details about the Environment Agency information supplied can be found on the GOV.UK website:

<https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather>

If you have requested this information to help inform a development proposal, then you should note the information on GOV.UK on the use of Environment Agency Information for Flood Risk Assessments.

<https://www.gov.uk/planning-applications-assessing-flood-risk>  
<https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion>

Please get in touch if you have any further queries or contact us within two months if you'd like us to review the information we have sent.

Yours sincerely

[Redacted Signature]

Customers & Engagement Officer

West Midlands Area

For further information please contact the Customers & Engagement team on

[Redacted Contact Information]

---

**From:** [Redacted]

**Sent:** 03 July 2020 15:47

**To:** Enquiries\_Westmids <Enquiries\_Westmids@environment-agency.gov.uk>

**Subject:** RE: Clarification Our Ref. 176150 - Flood Information Request - Land off Bath Road, Haresfield, Gloucester, GL10 3DP

Good Afternoon [Redacted]

I don't believe a Product 4 pack is necessary for this site, considering there are modelled watercourses located within the vicinity of the site. Therefore, a Product 1 pack should be sufficient.

Any information you hold regarding historic flood incidents within the vicinity of the site would also be appreciated.

If you require any further information then let me know.

Kind Regards,

[Redacted]

[Redacted]

Assistant Hydrologist  
RPS | Consulting UK & Ireland  
Salisbury House, 2a Tettenhall Road  
[Redacted] W1 4SA, United Kingdom



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---

**From:** Enquiries\_Westmids <[Enquiries\\_Westmids@environment-agency.gov.uk](mailto:Enquiries_Westmids@environment-agency.gov.uk)>

**Sent:** 03 July 2020 13:44

**To:** [Redacted]

**Subject:** Clarification Our Ref. 176150 - Flood Information Request - Land off Bath Road, Haresfield, Gloucester, GL10 3DP

**CAUTION:** This email originated from outside of RPS.

Thank you for your enquiry requesting information regarding the above.

- Can I just clarify what product you need as a Product 1 is just for a map please see 2<sup>nd</sup> pdf attachment

Our Ref. 176150

If we have not received the above information within 20 working days of this letter being issued the request for information will be deemed to have been withdrawn.

If you require any further clarification or assistance, please do not hesitate to contact a member of the Customer Services Team.

Yours faithfully

[Redacted]

Customers & Engagement Officer

## West Midlands Area

For further information please contact the Customers & Engagement team on  
Tel. [REDACTED]  
E-mail:- [Enquiries\\_WestMids@environment-agency.gov.uk](mailto:Enquiries_WestMids@environment-agency.gov.uk)

---

**From** [REDACTED]

**Sent:** 25 June 2020 11:32

**To:** Enquiries, Unit <[enquiries@environment-agency.gov.uk](mailto:enquiries@environment-agency.gov.uk)>

**Subject:** REF: 200701/BC04 Flood Information Request - Land off Bath Road, Haresfield, Gloucester, GL10 3DP

Good Morning,

We wish to enquire with you regarding flood information for a proposed commercial development at land off Bath Road, Haresfield, Gloucester, Gloucestershire, GL10 3DP. Please find attached a location plan for your reference.

Please could you provide a Product 1 information pack for the site, including flood maps (fluvial, surface water, groundwater) and any historic flood information within the vicinity of the site.

We will be completing a drainage strategy for this site, therefore do you have any site specific requirements in terms of drainage?

If you require any further information then don't hesitate to contact me.

Kind Regards,

[REDACTED]

[REDACTED]

Assistant Hydrologist  
RPS | Consulting UK & Ireland  
Salisbury House, 2a Tettenhall Road  
Wolverhampton, West Midlands WV1 4SA, United Kingdom  
**T** +44 1902 925 500  
**E** [josh.hughes@rpsgroup.com](mailto:josh.hughes@rpsgroup.com)



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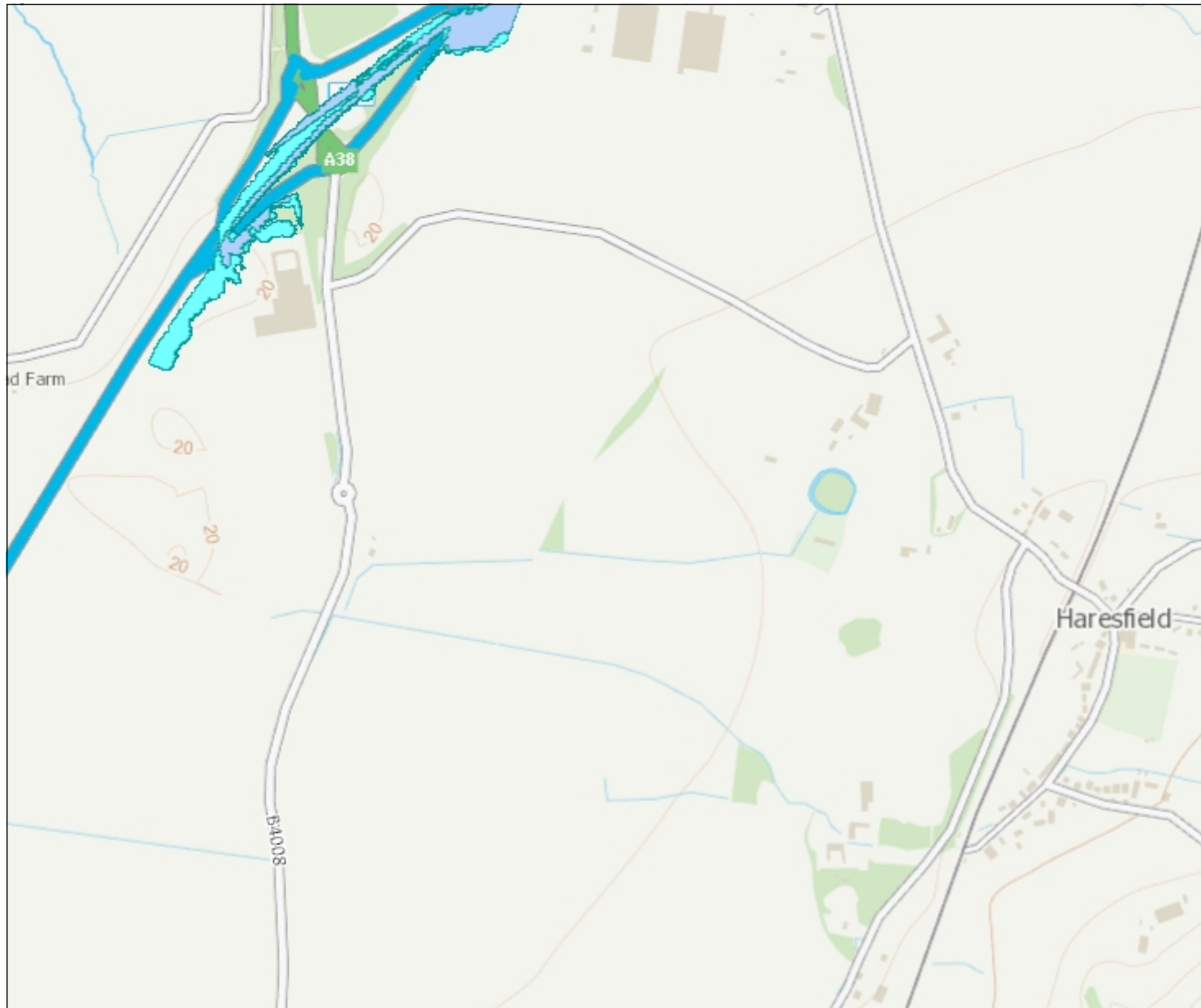
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# Flood Map for Planning (Rivers and Sea) centred GL10 3DP Ref. 176150 created 06.06.20



1: 10,000

0 Metres 250



## Flood Map for Planning (Rivers & Sea)

- Defences
- Flood Storage Areas
- Areas benefiting from flood defences
- Flood Zone 3
- Flood Zone 2
- All recorded flood outlines

### Flood Map Areas (assuming no defences)

**Flood Zone 3** shows the area that could be affected by flooding:

- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

**Flood Zone 2** shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

# Appendix E – Extract from Geo-Environmental Risk Assessment



# PHASE 1 PRELIMINARY GEO-ENVIRONMENTAL RISK ASSESSMENT

Symmetry Park East, Gloucester



JER8631  
PHASE 1 PRELIMINARY RISK  
ASSESSMENT  
00  
June 2020

## REPORT

### Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
00	Draft	T [REDACTED]			26/06/2020

### Approval for issue

[REDACTED] Associate Director 26 June 2020

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Prepared by:

**RPS**

[REDACTED]  
Geo-Environmental Consultant

Prepared for:

**Tritax Symmetry**

[REDACTED]  
Graduate Development Surveyor

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## EXECUTIVE SUMMARY

RPS Consulting Services Ltd (RPS) was commissioned by Tritax Symmetry to undertake a Phase 1 Preliminary Geo-Environmental Risk Assessment of land known as Symmetry Park East, Gloucester. The report has been commissioned prior to the proposed redevelopment of the site.

The principal objectives of the assessment will be to determine the potential for soil and groundwater contamination to be present which could impact future site users/occupiers and the wider environment, significantly constrain the proposed use of the site or significantly affect the development process. The site's suitability for its proposed use would be determined in accordance with the National Planning Policy Framework.

### Current Site and Surrounding Land Use

The site currently comprises undeveloped agricultural land, comprising three adjoining arable farmed fields. The site is in a predominantly rural location, surrounded by farmland on three sides and located south east of the M5 Quedgeley Interchange. To the west of the site, a recently constructed energy recovery facility has replaced a former light industrial estate and former airfield. There is also a Garden Centre to the west, and a business park (formerly RAF site) to the north.

### History of Site and Surrounding Land use

A review of historical maps indicates that the site's use has remained unchanged. Off-site historical potential sources of contaminants of concern include the former industrial estate, which featured sewage beds and tanks, the garden centre, and the former RAF site.

### Environmental Setting

The site is indicated to be underlain by a Secondary Undifferentiated Aquifer associated with the Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated). The site is in a zone of medium groundwater vulnerability.

The site is not located in a groundwater Source Protection Zone (SPZ) and there are no sensitive groundwater abstractions in the vicinity of the site.

The nearest surface water features are a series of field boundary ditches, the closest of which is located adjacent to the southern boundary of the site.

The closest residential property is located approximately 10m from the south of the site, however there are no other adjacent residential properties, schools, hospitals, care homes or other sensitive land uses in the near vicinity of the site.

### Outline Conceptual Site Model

An outline conceptual site model (CSM) has been derived on the basis of the desktop study and site reconnaissance, which has identified a limited number of potential sources of contamination and associated pollutant linkages. There is also the potential the generation of ground gas associated with infilled land on site and made ground/infilled land near the site.

### Recommendations

It is recommended that the potential for contamination and associated pollutant linkages is assessed through a Phase 2 Geo-Environmental Site Investigation. The investigation should be targeted to provide information on the concentrations of contaminants of concern (if present) within the soils and shallow groundwater beneath the site and the generation of ground gases. If the site investigation identifies the presence of potentially significant contamination or ground gases further investigation, monitoring, risk assessment and remediation may be necessary.

## REPORT

---

If contamination is present, increased materials management/disposal costs may be realised as part of the redevelopment. If excavated materials are to be reused on site a Materials Management Plan may be required and appropriate licenses/exemptions will be required.

It would be prudent to combine any site investigation undertaken for geo-environmental purposes with geotechnical testing. Soakaway testing could also be undertaken - low permeability soils could prevent the use of soakaways.

# 1 INTRODUCTION

## 1.1 Preamble

- 1.1.1 RPS Consulting Services Ltd (RPS) was commissioned by Tritax Symmetry to undertake a Phase 1 Preliminary Geo-Environmental Risk Assessment of Symmetry Park East, Gloucester. The report has been commissioned prior to the proposed redevelopment of the site.
- 1.1.2 The site covers an area of approximately 20.54 hectares and currently comprises undeveloped agricultural land. A site location plan is presented as Figure 1.
- 1.1.3 Development plans have not been made available for review at this time.

## 1.2 Objectives

- 1.2.1 The principal objectives of the assessment are to determine the potential for soil and groundwater contamination to be present which could impact future site users/occupiers and the wider environment, significantly constrain the proposed use of the site or significantly affect the development process.
- 1.2.2 The key tasks of this assessment were as follows:
- To assess potential sources of contamination at the site, associated with historical and current land uses both on site and in the surrounding area;
  - To review the environmental setting to assess the sensitivity of the surrounding area to ground contamination;
  - To produce an outline Conceptual Site Model (CSM) identifying the pathways by which potential contamination may impact the identified receptors via pollutant linkages; and,
  - To provide recommendations for further assessment/ investigation of potential pollutant linkages, where considered necessary

## 1.3 Legislation and Guidance

- 1.3.1 This report has been produced in general accordance with:
- Contaminated Land (England) Regulations 2006 (as amended);
  - DEFRA Environmental Protection Act 1990: Part 2A - *Contaminated Land Statutory Guidance* (2012);
  - DEFRA and Environment Agency (2004) Contaminated Land Report 11 (CLR 11): *Model Procedures for the Management of Land Contamination*;
  - National Planning Policy Framework (2019);
  - CIRIA Document C665: *Assessing Risks Posed by Hazardous Ground Gases to Buildings*;
  - British Standard requirements for the 'Investigation of potentially contaminated sites - Code of practice' (ref. BS10175:2011+A1:2017);
  - British Standard requirements for the 'Code of practice for ground investigations' (ref. BS5930:2015); and
  - British Standard requirements for the 'Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings' (ref BS8485:2015+A1:2019).
- 1.3.2 Details of the limitations of this type of assessment are described in Appendix A.

## 2 SITE RECONNAISSANCE AND DESK STUDY

### 2.1 Site Reconnaissance

2.1.1 This section of the report is based upon observations made during a site visit carried out on 30 June 2020. A site boundary plan is provided as Figure 2. Selected photos are shown in Appendix B.

#### The Site

**Table 1 – Summary of on-site activities**

Section	Description
Background:	The site is located south of Gloucester, near to the M5 Quedgeley Interchange at National Grid Reference SO804106. It is irregularly shaped and occupies an area of approximately 20.54 ha. The site slopes gently from the east to west at an elevation of between 20m and 30mAOD.
Site Layout:	The site comprises three arable agricultural fields bounded by hedgerows with woodland prominent on its eastern boundary.
Activity / Operations:	At the site of the site inspection site use was dominated by arable farmland with a public right of way running east to west in the south of the site.
Building Structure(s):	There were no buildings or structures present on site.
Surface Cover:	The majority of the site has topsoil cover.
Drainage:	Drainage ditches of various depths are located around the perimeter of the fields and are associated with hedgerows and trees. These were most prominent in the northwest of the site where a ditch of about 0.5 m depth was identified with steep slopes of several metres height behind this to the road to the north. A drainage ditch was also encountered in the south eastern corner of the site running east to west and joining the neighbouring field to the east.
Bulk Storage / Tanks:	There was no notable storage of materials or tanks on site.
Waste:	There was no notable waste stored on site.
Air Emissions:	The site does not operate any licensed air emissions.
Electricity Sub-Stations /Transformers:	No electricity substations or transformers were identified on site or in the immediate vicinity.
Visual Evidence of Contamination:	No visual evidence of surface contamination was identified during the site inspection.
Statutory Nuisance:	RPS is not aware of any statutory nuisance complaints associated with the site.
Other Issues:	None identified.

#### The Surrounding Area

2.1.2 The site is located in an area of mixed agricultural, retail, commercial and industrial land use. At the time of the site inspection, neighbouring land consisted of the following:

**Table 2 – Neighbouring Land Uses**

Direction	Description
North:	Agricultural land, light industrial business park. Large warehouse / office structures, with area of waste skips to the northwest beyond Stonehouse road.
East:	Agricultural land, rural residential
South:	Arable farmland with house located immediately to the southwest. Access route through field on southern boundary.
West:	Energy recovery facility, business park, garden centre

2.1.3 Several small drains/ditches were observed during the site inspection.



## 2.2 Site History

### Historical Map Review

2.2.1 The following review is based on past editions of readily available Ordnance Survey (OS) maps. These include scales of 1:1,250, 1:2,500 and 1:10,000 dated 1882 to 2020. Extracts from selected historical maps are provided as Figure 3 to Figure 8. The review is also based on available aerial photography dated 1999 to 2018.

**Table 3 – Historical Site Uses**

On-site Land Use and Features	Dates
Undeveloped agricultural land with field boundaries and footpath across centre	1882 - present
Small pond (central area)	1882 - 2001

**Table 4 – Historical Neighbouring Site Uses**

Surrounding Land Uses (250m radius)	Orientation	Distance	Dates	
			From	To
Stonehouse Lane – Diverts nearer to north western corner circa 1974	N	0m	1882	present
Lane – Becomes A419 circa 1971, bounding western perimeter – Becomes B4008 circa 1990	W	0m	1882	present
Track to St Peters Church	S	0m	1882	present
Lodge residential building	SW	10m	1901	present
Garden Centre Glasshouse – Becomes 'Countryside Centre', numerous additional structures circa 2001 – Smaller structures replaced by car park, large retail garden centre structure circa 2010	W	20m	1986	present
Bilton Industrial Estate – Becomes Bilton Cargo Centre circa 1990	W	30m	1971	2001
Javelin Park EFW facility	W	35m	2018	present
Mount farm tree plantation	E	80m	1882	present
M5 Motorway, Quedgeley Interchange – Junction road improvements, construction of roundabouts circa 2010	NW	180m	1971	present
Tank	W	200m	1971	2001
Airfield	W	214m	1949	1954
Sewage Beds	W	250m	1971	2001
RAF Quedgeley site 6 – Becomes Quedgeley East Business Park unknown date	N	250m	1971	present

2.2.2 Aerial photographs dated 1999 to 2018 suggest that the site use has remained unchanged. The photographs suggest that the land to the west of the site has undergone demolition of structures and redevelopment during this period.

## Site Planning History

2.2.3 Relevant planning records for the site, obtained from Stroud district and Gloucestershire County Council planning websites are summarised as follows:

- Land immediately adjacent to the north: Application references:
  - S.16/1724/OUT: Outline planning application for a business park comprising B1 (Business), B2 (General Industrial) and B8 (Storage or Distribution) including access arrangements and demolition of existing business park.
  - S.19/2611/DISCON Discharge of condition 12 (Land contamination part 5 - Validation) from the application S.16/1724/OUT for phase 1 only.
- Land adjacent to the west: Application references:
  - 12/0008/STMAJW Proposed development of an Energy from Waste (EfW) facility for the combustion of non-hazardous waste and the generation of energy, comprising the main EfW facility, a Bottom Ash processing facility and Education/Visitor Centre, together with Associated/Ancillary Infrastructure including Access Roads, Weighbridges, Fencing/Gates, Lighting, Emissions Stack, Surface Water Drainage Basins and Landscaping.
  - S.19/2135/FUL Erection of four buildings (5 units) for B1c (Light Industry), B2 (General Industry) and B8 (Storage and Distribution) uses and associated access and drainage infrastructure

## 2.3 Environmental Setting

### Geology

2.3.1 Based on British Geological Survey (BGS) mapping (1:50,000-scale) and the Environment Agency (EA) Groundwater Vulnerability mapping (1:100,000-scale), the stratigraphic sequence and aquifer classifications beneath the site are indicated to be as follows:

**Table 5 – Descriptions of Geological Strata**

Strata	Description	Aquifer Classification
Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated)	Mudstone. Marine calcareous mudstone and silty mudstone, and limestone.	Secondary Undifferentiated Aquifer

2.3.2 There are a number of BGS borehole records located approximately 200m to 300m to the north west of the site likely to be associated with the construction of the M5 Quedgeley Interchange. BGS Borehole reference SO81SW67, extends beyond 10m below ground level, the encountered stratigraphic sequence can be summarised as follows:

- Made Ground comprising firm brown sandy gravelly CLAY. 0.00 – 0.65m bgl
- Firm grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine flint and occasional limestone. 0.65 – 1.20m bgl
- Firm grey mottled orange brown slightly sandy CLAY. Rare subangular to angular flint gravel. Becoming very stiff at depth 1.20 – 2.80m bgl
- Stiff to very stiff grey green mottled orange slightly sandy Clay with occasional fine gypsum crystals 2.80 – 4.00m bgl

- Very stiff dark grey blue thinly laminated CLAY/very weak  
Completely weathered Mudstone. 4.00 – 7.00m bgl
- Very stiff to hard dark grey blue thinly laminated calcareous CLAY  
Including rare bands of limestone. 7.00 – 8.90m bgl
- Very Weak highly weathered dark grey blue thinly laminated  
Calcareous Mudstone with occasional shell fragments. 8.90 – 10.14m bgl.

2.3.3 There is the potential for Made Ground to be present on site, associated with its agricultural history and associated shallow soil workings. However, Made Ground of significant thickness is not anticipated to be widespread owing to the site’s limited history of development. There is the potential for infilled ground associated with a former pond identified in the centre of the site on historical mapping. At present the nature and thickness of any Made Ground on site is unknown.

## Hydrogeology

- 2.3.4 The site is located above a Secondary Undifferentiated Aquifer relating to the Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated). These formations have varying characteristics in different locations. According to Groundwater vulnerability mapping, the site is in a zone of medium vulnerability associated with groundwater flow through poorly connected rock fractures.
- 2.3.5 According to EA data, the site not located in a groundwater Source Protection Zone (SPZ).
- 2.3.6 Under the Water Framework Directive, the Environment Agency’s local River Basin Management Plan classifies groundwater chemical quality beneath the site as good quality (2016).
- 2.3.7 Information provided by the EA indicates that there are no records of active licensed groundwater abstractions within 2km of the site.

## Surface Water

2.3.8 There are no watercourses within 1km of the site which are classified within the River Basin Management Plan published by the EA under the European Water Framework Directive (2000). A list of all nearby watercourses and water bodies within 250m of the site is as follows:

**Table 6 – Nearby Watercourses and Water Bodies**

Watercourse / Body	Quality Classification	Approx. Distance and Direction from Site
Ditch/field drain	N/A	Adjacent to southern boundary
Ditch/field drain	N/A	100m south
Ditch/field drain	N/A	150m south
Ditch/field drain	N/A	250m north east
Pond	N.A	250m east

- 2.3.9 Information provided by the EA indicates that there are two records of active licensed surface water abstractions within 2km of the site.
- 2.3.10 There are two records of active surface water discharge consents within 500m of the site. These relate to the release of treated effluent/process effluent to tributaries of Beaufair Brook (373m West) and River Severn (489m North).
- 2.3.11 According to the Environment Agency (EA) flood risk mapping, the site has a number of locations at medium or high risk of surface water flooding, including in the centre of the site and in the north western corner of the site.

## Fluvial / Tidal Flood Risk

- 2.3.12 According to the Environment Agency (EA) flood map, the site is not located within an indicative fluvial floodplain, with the annual probability of flooding classified as less than 1 in 1000 (0.1%).

## Ecologically Sensitive Sites

- 2.3.13 Natural England data indicates that there are no ecologically sensitive sites, that constitute environmental receptors as defined within Table 1 of the DEFRA Environmental Protection Act 1990: Part 2A - Contaminated Land Statutory Guidance (2012), located within a 1km radius of the site.
- 2.3.14 According to Natural England data, the site is located within a designated SSSI impact risk zone, these require consultation for all developments including infrastructure, energy and residential.

## Other Sensitive Sites

- 2.3.15
- 2.3.16 There are no records of World Heritage Sites, National Parks, Listed Buildings, Conservation Areas or Scheduled Ancient Monuments within 250m of the site.

## Radon

- 2.3.17 According to the Indicative Atlas of Radon in England and Wales published by the Health Protection Agency (part of Public Health England) and the British Geological Survey, the site is located within an area where less than 1% of properties are affected by radon and no radon protection measures are required.

## Coal Authority

- 2.3.18 The Interactive Map Viewer on the Coal Authority website indicates that the site is not located in a coal mining reporting area.

## Non-Coal Mining

- 2.3.19 There are no records of natural cavities, surface or underground workings, non-coal mining or other mineral extraction operations within 1km of the site.

## Natural Land Stability

- 2.3.20 BGS data indicates that the site is located within an area at low risk from shrink swell clays and very low risk from collapsible deposits and landslides. The risk associated with running sands, compressible deposits and ground dissolution is indicated to be negligible.

## 2.4 Authorised Processes and Pollution Incidents

### Landfills and Waste Sites

- 2.4.1 Data provided by the EA, Local Authority and BGS indicates that there are no recorded licensed or known historical landfill sites located within 250m of the site.
- 2.4.2 Information provided by a number of sources (detailed below) shows that there is one waste treatment/transfer sites recorded within 250m of the site. This is described within the following table.

**Table 7 – Landfill / Waste Transfer / Waste Treatment Sites**

Source of Record	Approx. Distance and Direction	Licence Details	Waste Type and Details
<b>Waste Transfer / Treatment Sites</b>			
Waste Treatment Project	158m W	Application date 2013	Application associated with construction of an energy from waste project. Incineration and mechanical biological treatment of residential waste.

## Environmental Permits

- 2.4.3 EA and Local Authority data indicates that there are processes regulated by an Environmental Permit (under the Environmental Permitting Regulations 2010) within 500m of the subject site. This is described within the following table.

**Table 8 – Environmental Permits**

Licence Holder	Approx. Distance and Direction from Site	Permitted Activity
Urbaser Environmental Limited Javelin Park Energy Recovery Facility EPR/CP3535CK Permit Number: KP3439YD Status: Effective	211m west	Process: Incineration of non-hazardous waste
St Josephs Travellers Park, Hiltmead Lane, Moreton Valence, Gloucester, Gloucestershire, GL2 7NQ EPRDP3327GC	373m west	Discharge of sewage to tributary of Beaufair Brook
Colethrop Farm, Haresfield	489m north	Trade discharge: process effluent to tributary of River Severn.

- 2.4.4 There are a number of waste exemptions within 500m of the site associated with agricultural processes including cleaning, storage, spreading and burning of wastes.

## COMAH Sites

- 2.4.5 There is one record of operations under the Control of Major Accident Hazards (COMAH) Regulations 1999, located within 500m of the site. This relates to WL Vallance Ltd, Unit 11 Javelin Park, 17m west of the site. This is a historical NIHHS site.

## Pollution Incidents

- 2.4.6 Environment Agency data indicates that there are no records of 'major' or 'significant' pollution incidents within 500m of the site.

## 2.5 Unexploded Ordnance

- 2.5.1 Reference to the online interactive Zetica Regional Unexploded Bomb Risk map for indicates that the site is in an area of low potential risk from Unexploded Bombs. However, the site is in an area of known military history associated with RAF Quedgeley site 6 located 250m north, in general

accordance with CIRIA Report consideration of undertaking further risk assessment in the form of a Desk Based Threat Assessment should be considered.

## 3 PRELIMINARY CONCEPTUAL SITE MODEL

### 3.1 Background

3.1.1 An preliminary conceptual site model (CSM) consists of an appraisal of the *source-pathway-receptor* 'contaminant linkages' which is central to the approach used to determine the existence of 'contaminated land' according to the definition set out under Part 2A of the Environmental Protection Act 1990. For a risk to exist (under Part 2A), all three of the following components must be present to facilitate a potential 'pollutant linkage'.

- **Source** referring to the source of contamination (Hazard).
- **Pathway** for the contaminant to move/migrate to receptor(s).
- **Receptor** (Target) that could be affected by the contaminant(s).

3.1.2 Receptors include human beings, controlled waters and buildings / structures. The National Planning Policy Framework, used to address contaminated land through the planning process, follows the same principles as those set out under Part 2A. Further details on the Part 2A regime are presented within Appendix C.

### 3.2 Potential Pollutant Linkages

3.2.1 Each stage of the potential pollutant linkages have been assessed individually on the basis of information obtained during the site reconnaissance, and desk study exercise and are discussed in the following section.

#### Potential Contaminant Sources

##### On Site – Current Land Use

- 3.2.2 Current agricultural use of the site is unlikely to result in significant contamination. There is the potential for diffuse pesticide/herbicide contamination to be present and the potential for localised hydrocarbon contamination associated with any fuel/oils spills associated with vehicles and agricultural machinery.
- 3.2.3 Made Ground may be present beneath the site, and there is the potential for infilled ground associated with a former pond identified in the centre of the site. Where present this could represent a potential source of contamination and / or ground gas and could contain contaminants such as asbestos.

##### On Site – Historical Land Uses

- 3.2.4 Historical use of the site appears to be largely limited to agricultural uses. There is the potential for diffuse pesticide/herbicide contamination to be present and the potential for localised hydrocarbon contamination associated with any fuel/oils spills associated with vehicles and agricultural machinery.

##### Off-site – Current Land Uses

- 3.2.5 Current off-site potential sources of contamination include the Javelin Park Energy Recovery Facility. Waste processing and other operations at the facility represent a potential source of contaminants including metals, hydrocarbons and other organic compounds.

##### Off-Site – Historical Land Uses

- 3.2.6 Historical use of the area surrounding the site which includes Bilton Industrial estate, tanks, sewage beds, airfield, RAF Quedgeley site no.6, garden centre, Quedgeley Interchange, etc may

have resulted in a wide range of inorganic and organic contaminants including metals, asbestos, hydrocarbons and solvents. There is also the potential for the generation of ground gas associated with any filled land. The Airfield and RAF site may also have been used to store/test munitions.

- 3.2.7 Construction of the Quedgeley Interchange to the north west of the site may have included cut/fill schemes creating significant volumes of made ground which may represent a potential source of ground gas.

### Potential Pathways

- 3.2.8 In areas of the completed development covered by buildings or hardstanding the risks to human health receptors associated with ground contamination (if present) via the pathways of dermal contact, ingestion and dust inhalation will be mitigated by the surface cover. However, in areas of soft landscaping, these pathways could be active. In addition, there would be potential for the airborne migration of soil/dust from these areas to the wider site and off site.
- 3.2.9 There is the potential for ground gas and volatile contaminants of concern in soil and/or groundwater (if present) beneath the site to impact future site users via the inhalation pathway in indoor areas of the completed development.
- 3.2.10 The site is indicated to be underlain by the low permeability Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated), which will likely limit the vertical migration of contaminants of concern to deeper groundwater and mitigate the lateral off-site and on-site migration of contaminants of concern via shallow groundwater (where present).

### Potential Receptors

- 3.2.11 Post development human health receptors include site users and neighbouring site users.
- 3.2.12 During the redevelopment process, construction personnel and neighbouring site users may be at increased risk from ground contamination, especially if soils are being disturbed. Providing construction workers adopt appropriate levels of hygiene and personal protective equipment based on appropriate risk assessment in accordance with the requirement of the CDM Regulations 2015, they are not considered to be at significant risk from potential contaminants of concern and have not been considered further as part of this assessment. Dust mitigation measures may be necessary to protect neighbouring sites users.
- 3.2.13 The nearest surface water features are a series of field drains/ditches which cross the site and off-site ones, the closest of which is located adjacent to the south of the site. Measures may need to be implemented during the redevelopment process to protect surface water receptors.

## 3.3 Preliminary Conceptual Site Model

- 3.3.1 An preliminary CSM has been developed on the basis of the site reconnaissance and desk study. The CSM is used to identify potential sources, pathways and receptors (i.e. potential pollutant linkages) on site and is summarised in the table below:



**Table 9 – Preliminary Conceptual Site Model**

Potential Source	Contaminants of Concern	Via	Potential Pathways	Post Development Linkage Potentially Active?	Receptors
<b>On site :</b> Undeveloped agricultural land	Metals, asbestos, hydrocarbons. Potential for diffuse pesticides/herbicides	Soil	Direct contact/ingestion	✓	Future site users
			Inhalation of volatiles	✓	
			Airborne migration of soil or dust	✓	Off-site users
			Leaching of mobile contaminants	✗	Secondary Undifferentiated Aquifer Field drains and ditches
		Groundwater	Direct contact/ingestion	✗	Future site users Off-site users
			Inhalation of volatiles	✓	Future site users Off-site users
			Vertical and lateral migration in permeable strata	✗	Secondary Undifferentiated Aquifer Field drains and ditches
<b>Off-site – current:</b> Energy Recovery Facility	Metals, asbestos, hydrocarbons, solvents,	Groundwater	Direct contact/ingestion	✓	Future site users
			Inhalation of volatiles	✓	Future site users
<b>Off site – historical:</b> Industrial estate, including tanks and sewage beds, airfield, RAF site, garden centre.					
<b>On and off-site –</b> Made Ground	Carbon dioxide and methane	Ground Gas	Inhalation of ground gas	✓	Future site users
				✓	
			Explosive risks	✓	Future site users
				✓	Off-site users

3.3.2 The risk assessment is based upon the available information relating to the site. Should ground conditions inconsistent with those outlined in this report be encountered RPS should be contacted to enable further assessment.

## 4 PRELIMINARY GEOTECHNICAL ASSESSMENT

### 4.1 Preliminary Geotechnical Risk Register

4.1.1 The following table provides a summary of key potential geotechnical hazards including preliminary indication of whether the site is likely to be affected by the hazard.

**Table 10 – Preliminary Geotechnical Risk Register**

Hazard Description	Potential for Hazard Low/Moderate/High	Comments
Sudden lateral / vertical changes in ground conditions	Low to Moderate	<p>Published BGS information indicates the ground conditions across the site are likely to be largely consistent with no superficial deposits indicated to be present beneath the site. Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated) is mapped as underlying the site.</p> <p>Although Made Ground is not mapped across the site it may be present locally at variable thickness associated with the former use and may give rise to some inconsistency.</p> <p>Variation in the nature and distribution of soils may result in the potential for excessive differential and total settlement for proposed structures, dependent on the foundation solutions adopted.</p>
Deeper pockets of Made Ground	Low to Moderate	<p>There is the potential for deeper pockets of Made Ground to be present associated with historical infilling of ponds and hollows.</p> <p>Made Ground has the potential for uncontrolled settlement which could result in excessive creep, differential and total settlement of buildings and infrastructure.</p> <p>Made Ground is generally not a suitable founding strata and foundation maybe required to penetrate the full thickness and found in competent underlying natural strata.</p> <p>There is a potential for buried obstructions to be present within any Made Ground associated with the historical land uses.</p>
Highly compressible / low bearing capacity soils, (including peat and soft clay)	Low to Moderate	<p>There is a potential for pockets of low strength clays to be present within the weathered portion of the Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated).</p> <p>Low strength weathered strata could result in excessive differential and total settlement of buildings and infrastructure.</p>
Ground dissolution features / natural cavities	Low	Ground conditions beneath the site are not consistent with these conditions.
Shrinking and swelling clays	Moderate	<p>The near surface soils may be of low to moderate volume change potential (this should be confirmed via geotechnical laboratory testing), which could result in settlement / heave of foundation and earthworks in particular when located within the influences of trees.</p> <p>Mature trees have been identified adjacent to the site. The potential effect of these on the depth required for the foundation should be assessed in accordance with the NHBC Manual guidelines.</p> <p>To mitigate the effects of potential heave or shrinkage, formation levels within these strata should be protected</p>

## REPORT

Hazard Description	Potential for Hazard Low/Moderate/High	Comments
		from the action of trees and vegetation and their exposure time kept to a minimum prior to casting and buried concrete.
Slope stability issues	Low to Moderate	Any significant slopes present on site or any temporary slopes created as part of the development should be subject to appropriate geotechnical design based on site-specific site investigation information.
High groundwater table (including waterlogged ground)	Low to Moderate	There is the potential for shallow perched groundwater to be present beneath the site associated with the Made Ground. Groundwater control/exclusion measures may be required to enable formation of any excavations required at the site depending on localised conditions. This may include pump and pumping, dewatering or sheet piled cofferdams in extreme circumstances. However, requirements for this should be confirmed via intrusive investigation and subsequent groundwater level monitoring.
Underground mining	Low	Ground conditions beneath the site are not consistent with these risk factors.
Concrete classification	Moderate	Any Made Ground may contain sulphate bearing soils. Chemical laboratory analysis should be undertaken on soil samples collected from each strata encountered beneath the site to determine a Design Sulphate Class and an Aggressive Chemical Environment for Concrete (ACEC) Classification for proposed buried structures as part of the development.
Seismic Activity	Low	The Eurocode 8 seismic hazard zoning maps for the UK (Musson and Sargeant, 2007) indicate that horizontal Peak Ground Acceleration (PGA) values with 10% probability of being exceeded in 50 years (475 year return period) are between 0.00 and 0.02g, which is considered very low.
Radon	Low	BGS and Public Health England data indicates that the site is located within an area where less than 1% of properties are above the action level. No radon protection measures are necessary.

## 5 CONCLUSIONS AND RECOMMENDATIONS

- 5.1.1 The outline CSM produced as part of this Preliminary Risk Assessment has identified a number of potential sources of contamination that could have resulted in soil or groundwater contamination. There is also a limited potential for the generation of ground gas.
- 5.1.2 There is the potential for several pollutant linkages to be active on completion of the development that could impact human health receptors. Given the environmental setting, controlled waters receptors are unlikely to be at significant risk.
- 5.1.3 It is therefore recommended that the presence of potential contaminants and ground gas is investigated as part of a Phase 2 Geo-Environmental Site Investigation prior to redevelopment of the site. The scope of this investigation should include the following:
- Drilling of a number of shallow boreholes across the site;
  - Installation of groundwater and gas monitoring wells in boreholes;
  - Collection of representative soil and groundwater samples from beneath the site with chemical analysis of these samples for identified contaminants of concern;
  - Collection of presentative soil samples from beneath the site with geotechnical laboratory testing to allow geotechnical classification of the underlying ground conditions.
  - Ground gas monitoring in wells installed across the site;
  - Assessment of ground conditions and generic quantitative risk assessment of soil and groundwater chemical analysis results to determine the potential for the identified potential pollutant linkages to remain active upon redevelopment of the site;
  - Geotechnical Assessment of ground condition to facilitate preliminary foundation and pavement design and excavatability; and
  - Provision of recommendations (where necessary) for remediation/mitigation measures to ensure that any identified potential pollutant linkages are not active upon redevelopment of the site.
- 5.1.4 If the site investigation identifies the presence of potentially significant contamination or ground gases further investigation, monitoring, risk assessment and remediation may be necessary.
- 5.1.5 It is likely that the pollutant linkages will be such that they could be mitigated by the use of typical measures such as a surface cover system, gas protection measures and 'barrier' water supply pipe. There may however be a requirement for a degree of remediation and increased soil/groundwater disposal cost may be realised. If excavated materials are to be reused on site a Materials Management Plan may be required and appropriate licenses/exemptions will be required.
- 5.1.6 It would be prudent to combine any site investigation undertaken for geo-environmental purposes with a geotechnical site investigation. It may also be beneficial to incorporate soil permeability testing to inform preliminary SUDS design – low permeability soils could prevent the use of soakaways.

## Appendix F – Severn Trent Water Developer Enquiry and Sewer Records

# WONDERFUL ON TAP



Severn Trent Water Ltd  
Regis Road  
Wolverhampton  
WV6 8RU

Tel: 0345 2667930  
www.stwater.co.uk  
net.dev.west@severntrent.co.uk

Contact: [REDACTED]

Your ref:  
Our ref: 8418461

RPS Consulting Services Ltd  
Salisbury House  
Tettenhall Road  
Wolverhampton  
WV1 4SA  
FAO [REDACTED]

13 July 2020

Dear [REDACTED]

## **Proposed Development at Bath Road/Gloucester Road, Haresfield, Gloucester GL10 3DP**

I refer to your 'Development Enquiry Request' in respect of the above site for 10 commercial units. Please find enclosed the sewer records that are included in the fee together with the Supplementary Guidance Notes which refer to surface water disposal from development sites.

### **Public Sewers in Site – Required Protection**

Due to a change in legislation on 1 October 2011, there may be former private sewers on the site which have transferred to the responsibility of Severn Trent Water Ltd, which are not shown on the statutory sewer records, but are located in your client's land. These sewers would have protective strips that we will not allow to be built over. If such sewers are identified to be present on the site, please contact us for further guidance.

### **Foul Water Drainage**

The sewer records show a 150mm diameter foul water sewer feeding into the Bath Road Pumping Station near the garden centre. There is also a 150mm diameter combined sewer to the north east, part of which has recently been diverted. Due to the recently constructed commercial unit site on the Quedgley East Business Park and the possibility of 10 units between the two sites shown on your plan with this application, there may be a need to undertake hydraulic modelling as I feel the Bath Road and RAF Quedgley No.6 Pumping Stations may need upgrading to increase capacity in the area. In this respect I would appreciate an estimation of the average and peak flow rates from each unit based on the type of property proposed. I will then arrange for hydraulic modelling if deemed necessary.

### **Surface Water Drainage**

# WONDERFUL ON TAP



The sewer records show a watercourse system to the southern boundary of the site to the east and roughly through the middle of the site to the west. There are other watercourses to the south and north west of the development area also. Under the terms of Section H of the Building Regulations 2010, the disposal of surface water by means of soakaways should be considered as the primary method. In the event that following testing, it is demonstrated that soakaways would not be possible on the site, then satisfactory evidence will need to be submitted. The evidence should be either percolation test results or a statement from the SI consultant (extract or a supplementary letter).

Should the above method prove unsuccessful, a connection to the watercourse system is appropriate with restricted Greenfield flows in accordance with the Lead Local Flood Authority's conditions as statutory consultee in the planning process. Please see the guidance notes attached for further information.

## New Connections

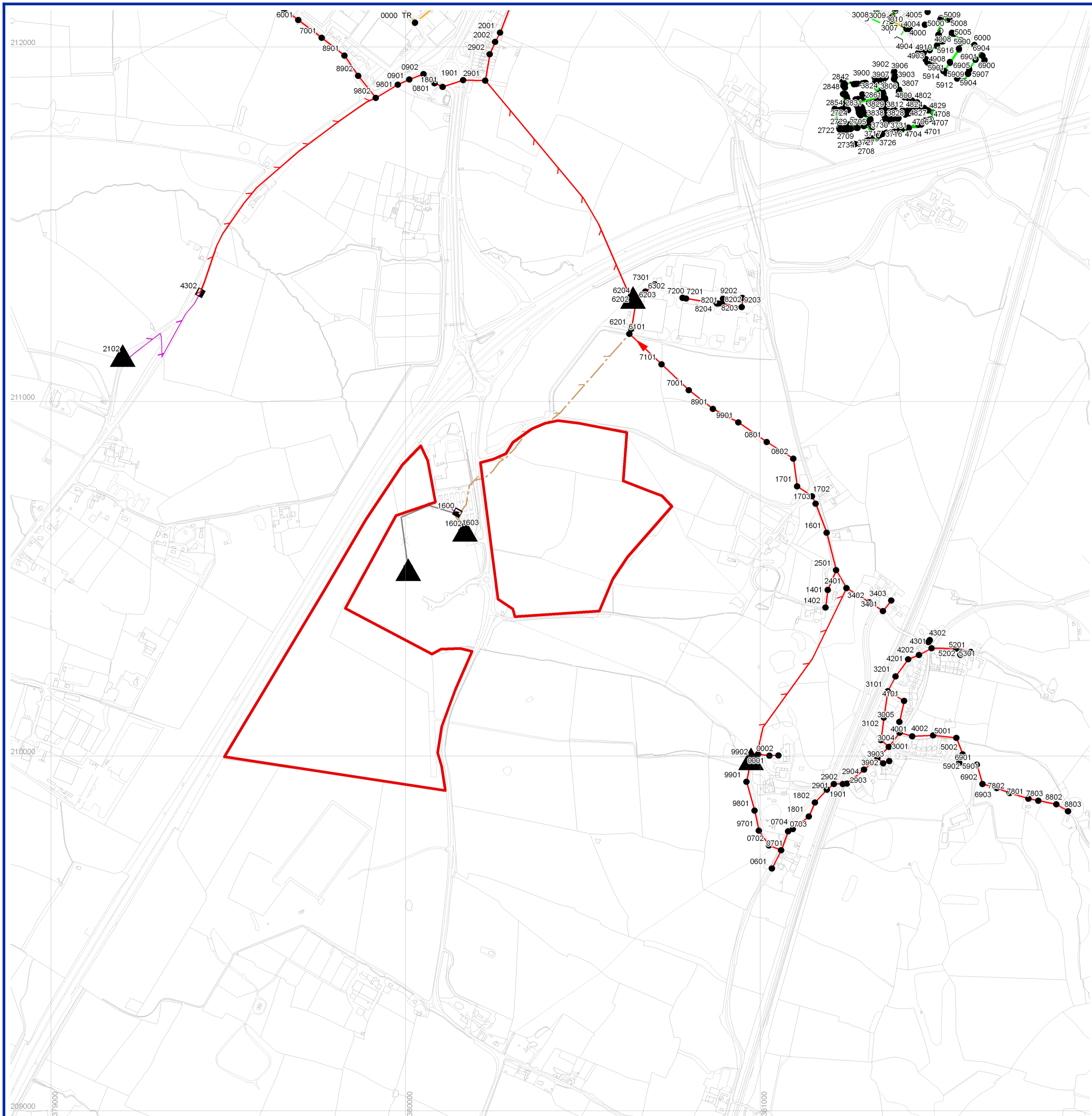
For any new connections (including the re-use of existing connections) to the public sewerage system, the developer will need to submit Section 106 application forms. Our New Connections department are responsible for handling all such enquiries and applications. To contact them for an application form and associated guidance notes please call 0800 7076600 or download from [www.stwater.co.uk](http://www.stwater.co.uk).

Please quote 8418461 in any future correspondence (including e-mails) with STW Limited. Please note that 'Development Enquiry' responses are only valid for 6 months from the date of this letter.

Yours sincerely

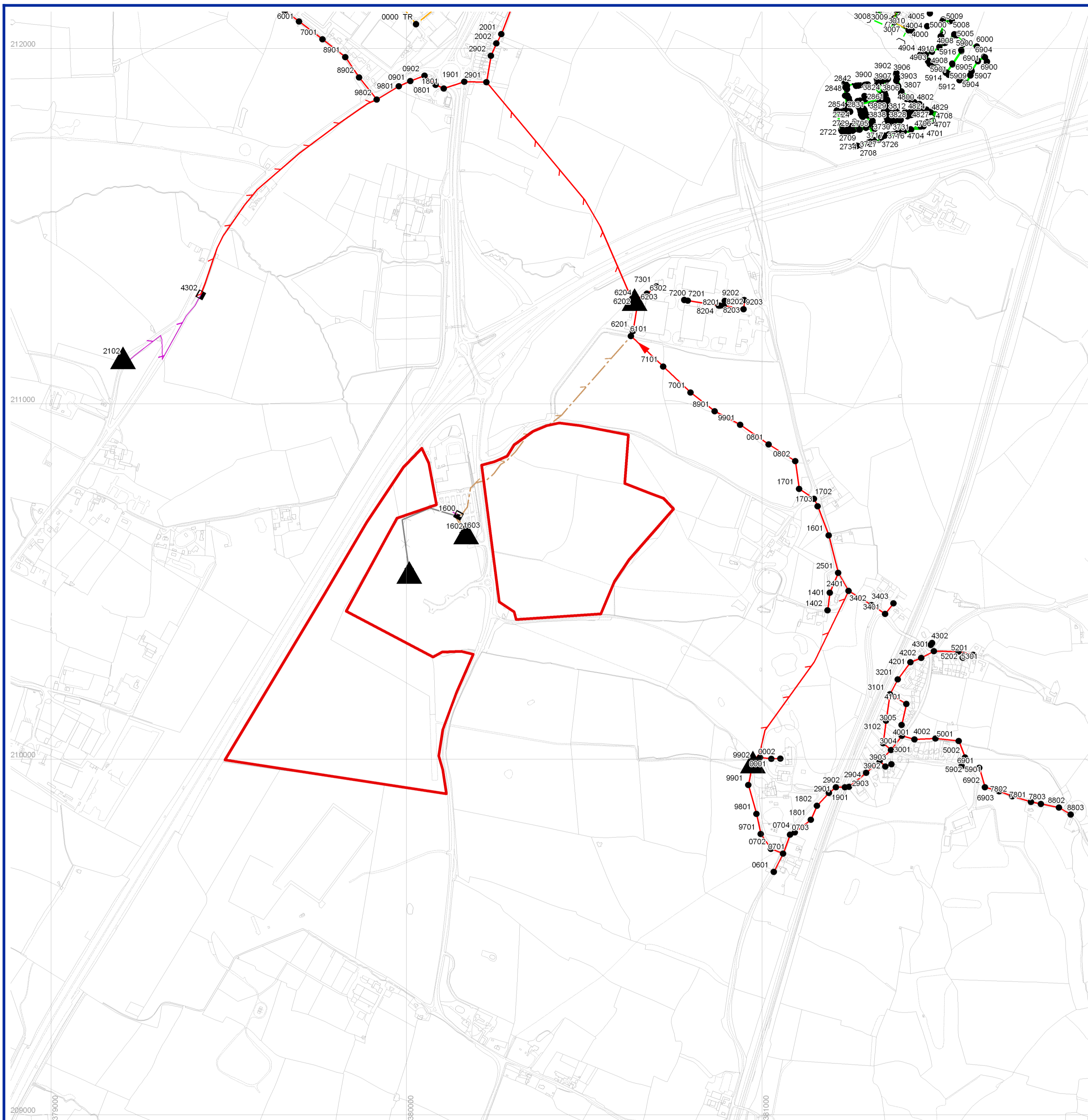


Asset Protection (Waste Water) West  
Chief Engineers Department



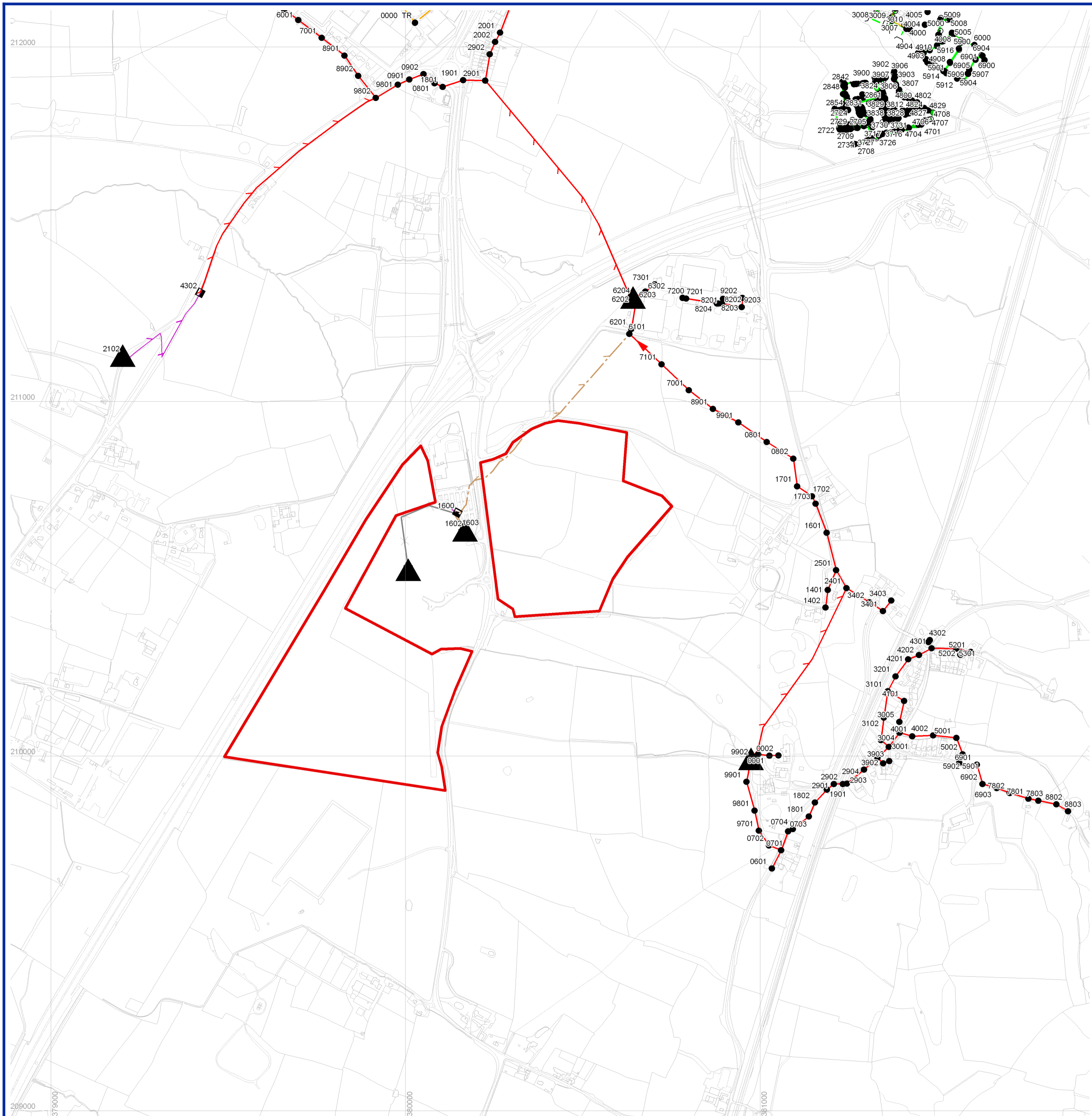
Sewer Node											Sewer Pipe Data										
REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID	REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SO7918901	14.76	13.35	13.00	C	VC	C	225	nil	232.06	nil	SO8110202	nil	nil	nil	C	VC	C	150	nil	0.00	nil
SO7918902	16.05	13.96	13.36	C	VC	C	225	nil	115.57	nil	SO8110203	45.19	43.03	41.78	C	VC	C	150	nil	55.22	nil
SO7918901	nil	nil	14.83	C	VC	C	nil	nil	0.00	nil	SO8112700	27.07	25.12	24.72	F	U	C	nil	nil	151.79	nil
SO7918902	16.68	14.78	14.01	C	VC	C	225	nil	99.60	nil	SO8112701	27.08	23.89	23.66	S	U	C	nil	nil	239.02	nil
SO7918901	14.09	12.52	12.21	C	VC	C	225	nil	148.97	nil	SO8112702	27.38	24.79	24.16	F	U	C	nil	nil	76.51	nil
SO8112701	14.55	12.99	12.54	C	VC	C	225	nil	184.22	nil	SO8112703	25.65	25.20	25.20	F	U	C	nil	nil	38.17	nil
SO8099701	38.63	36.56	36.58	C	VC	C	150	nil	59.89	nil	SO8112704	26.00	25.60	25.60	F	U	C	nil	nil	74.20	nil
SO8099901	37.48	35.58	34.12	C	VC	C	150	nil	57.49	nil	SO8112705	nil	25.60	25.45	F	U	C	nil	nil	75.62	nil
SO8099901	36.25	34.12	32.89	C	VC	C	150	nil	54.85	nil	SO8112706	25.45	25.40	25.40	F	U	C	nil	nil	91.14	nil
SO8091603	nil	nil	nil	F	U	C	nil	nil	0.00	nil	SO8112707	26.80	26.70	26.70	F	U	C	nil	nil	72.12	nil
SO8098901	27.43	25.21	23.72	C	VC	C	150	nil	57.86	nil	SO8112708	26.70	26.55	26.55	F	U	C	nil	nil	80.22	nil
SO8090301	37.14	36.11	32.04	C	VC	C	150	nil	5.86	nil	SO8112709	26.55	26.30	26.30	F	U	C	nil	nil	85.02	nil
SO8090901	28.90	26.52	25.23	C	VC	C	150	nil	63.11	nil	SO8112710	26.35	25.95	25.95	F	U	C	nil	nil	48.53	nil
SO80910801	18.22	16.02	15.89	C	VC	C	225	nil	311.23	nil	SO8112711	25.50	25.45	25.45	F	U	C	nil	nil	83.85	nil
SO80910901	17.42	15.49	15.49	C	VC	C	225	nil	0.00	nil	SO8112712	25.50	25.25	25.25	F	U	C	nil	nil	0.00	nil
SO80910902	18.02	15.89	15.58	C	VC	C	225	nil	138.97	nil	SO8112713	25.20	25.12	25.12	F	U	C	nil	nil	61.30	nil
SO80911801	18.38	16.38	16.05	C	VC	C	225	nil	76.00	nil	SO8112714	25.25	25.20	25.20	F	U	C	nil	nil	48.46	nil
SO80911901	18.84	16.73	16.42	C	VC	C	225	nil	195.90	nil	SO8112715	25.60	25.50	25.50	F	U	C	nil	nil	65.43	nil
SO80912901	18.68	17.15	16.77	C	VC	C	225	nil	163.24	nil	SO8112716	25.40	25.25	25.25	F	U	C	nil	nil	78.94	nil
SO80912902	19.33	17.78	17.34	C	VC	C	150	nil	170.75	nil	SO8112717	25.85	25.48	25.48	F	U	C	nil	nil	33.90	nil
SO80914101	22.42	20.74	20.38	C	VC	C	225	nil	40.81	nil	SO8112718	25.95	25.55	25.55	F	U	C	nil	nil	29.89	nil
SO80914201	22.23	19.89	19.89	C	VC	C	225	nil	122.69	nil	SO8112719	26.25	26.30	26.30	F	U	C	nil	nil	79.85	nil
SO80914202	21.66	19.11	19.10	C	VC	C	300	nil	444.33	nil	SO8112721	26.10	25.95	25.95	S	U	C	nil	nil	72.47	nil
SO80914203	22.32	19.87	19.33	C	VC	C	225	nil	26.68	nil	SO8112722	25.95	25.15	25.15	S	U	C	nil	nil	15.64	nil
SO80914302	21.90	19.65	19.18	C	VC	C	nil	nil	72.62	nil	SO8112723	25.15	23.89	23.89	S	U	C	nil	nil	4.49	nil
SO80917001	25.58	23.71	22.47	C	VC	C	150	nil	85.60	nil	SO8112724	26.25	26.10	26.10	S	U	C	nil	nil	66.45	nil
SO80917101	24.49	22.44	22.27	C	VC	C	150	nil	732.47	nil	SO8112725	26.20	25.95	25.95	S	U	C	nil	nil	33.82	nil
SO80917201	23.08	20.92	20.81	C	VC	C	nil	nil	0.00	nil	SO8112726	26.35	26.10	26.10	S	U	C	nil	nil	63.07	nil
SO80917301	nil	19.74	19.74	C	VC	C	nil	nil	0.00	nil	SO8112727	25.80	25.70	25.70	S	U	C	nil	nil	48.80	nil
SO80918201	nil	22.48	22.48	C	VC	C	nil	nil	0.00	nil	SO8112728	26.05	25.80	25.80	S	U	C	nil	nil	67.82	nil
SO80918202	23.76	22.14	21.97	C	VC	C	150	nil	58.82	nil	SO8112729	25.95	25.70	25.70	S	U	C	nil	nil	39.60	nil
SO80918203	23.77	21.96	21.90	C	VC	C	150	nil	66.67	nil	SO8112730	26.40	25.95	25.95	S	U	C	nil	nil	6.58	nil
SO80918204	23.71	21.90	20.98	C	VC	C	150	nil	96.70	nil	SO8112731	26.65	26.25	26.25	S	U	C	nil	nil	72.08	nil
SO80919202	24.24	23.46	22.84	C	VC	C	100	nil	42.06	nil	SO8112732	26.25	25.16	25.16	S	U	C	nil	nil	6.11	nil
SO80919203	24.27	22.76	22.14	C	VC	C	150	nil	91.76	nil	SO8112733	26.40	26.15	26.15	S	U	C	nil	nil	75.72	nil
SO80920001	nil	nil	nil	F	U	U	nil	nil	0.00	nil	SO8112734	26.15	25.90	25.90	S	U	C	nil	nil	84.62	nil
SO80922001	20.62	18.22	18.22	C	VC	C	150	nil	0.00	nil	SO8112800	26.45	24.31	24.16	F	U	C	nil	nil	151.80	nil
SO80922002	nil	nil	nil	C	VC	C	nil	nil	0.00	nil	SO8112801	26.25	24.56	24.56	F	U	C	nil	nil	162.45	nil
SO80926001	40.59	39.24	37.72	C	VC	C	150	nil	37.37	nil	SO8112802	26.18	24.56	24.56	F	U	C	nil	nil	163.72	nil
SO8092701	40.09	37.69	37.25	C	VC	C	150	nil	81.95	nil	SO8112803	26.19	24.72	24.56	F	U	C	nil	nil	152.19	nil
SO8092702	39.86	37.22	36.57	C	VC	C	150	nil	77.66	nil	SO8112804	26.12	25.04	24.64	F	U	C	nil	nil	151.53	nil
SO8092703	39.71	38.10	37.74	C	VC	C	150	nil	145.97	nil	SO8112805	26.35	24.16	24.06	F	U	C	nil	nil	153.90	nil
SO8092704	39.84	38.27	38.14	C	VC	C	150	nil	103.23	nil	SO8112806	26.94	25.31	25.21	F	U	C	nil	nil	139.64	nil
SO8091801	nil	38.30	38.30	C	VC	C	nil	nil	0.00	nil	SO8112807	26.02	25.21	25.04	F	U	C	nil	nil	152.18	nil
SO8091802	40.20	39.04	39.04	C	VC	C	150	nil	0.00	nil	SO8112808	26.44	23.38	23.17	S	U	C	nil	nil	168.55	nil
SO8091901	nil	39.05	39.05	C	VC	C	nil	nil	0.00	nil	SO8112809	26.21	23.56	23.46	S	U	C	nil	nil	329.31	nil
SO8092901	42.16	39.71	39.71	C	VC	C	150	nil	0.00	nil	SO8112810	26.18	23.58	23.56	S	U	C	nil	nil	327.96	nil
SO8092902	nil	39.71	39.71	C	VC	C	nil	nil	0.00	nil	SO8112811	26.22	26.66	23.58	S	U	C	nil	nil	8.82	nil
SO8092903	43.13	40.02	40.02	C	VC	C	150	nil	0.00	nil	SO8112812	26.10	24.74	24.26	S	U	C	nil	nil	125.46	nil
SO8092904	43.39	40.16	40.05	C	VC	C	150	nil	580.82	nil	SO8112813	26.64	24.91	24.74	S	U	C	nil	nil	150.49	nil
SO8093901	43.55	40.47	40.16	C	VC	C	150	nil	155.39	nil	SO8112814	26.97	25.01	24.91	S	U	C	nil	nil	133.41	nil
SO8093902	45.13	43.06	42.12	C	VC	C	150	nil	24.26	nil	SO8112815	25.30	24.56	24.56	F	U	C	nil	nil	24.06	nil
SO8093903	44.73	43.20	43.07	C	VC	C	150	nil	138.69	nil	SO8112816	25.45	25.30	25.30	F	U	C	nil	nil	64.01	nil
SO8093901	51.92	49.87	48.61	C	VC	C	150	nil	21.37	nil	SO8112817	25.65	25.00	25.00	F	U	C	nil	nil	10.05	nil
SO8093902	51.76	49.67	48.30	C	VC	C	150	nil	106.25	nil	SO8112818	24.95	24.87	24.87	F	U	C	nil	nil	59.70	nil
SO8093901	nil	50.08	50.08	C	VC	C	nil	nil	0.00	nil	SO8112819	25.45	24.95	24.95	F	U	C	nil	nil	57.56	nil
SO8093902	55.11	53.54	53.54	C	VC	C	150	nil	0.00	nil	SO8112820	25.45	24.95	24.95	F	U	C	nil	nil	8.24	nil
SO8093903	56.33	54.55	53.56	C	VC	C	150	nil	41.90	nil	SO8112821	25.00	24.82	24.82	F	U	C	nil	nil	30.48	nil
SO8093901	63.94	62.43	62.40	C	VC	C	150	nil	11.01	nil	SO8112822	24.90	24.31	24.31	F	U	C	nil	nil	9.09	nil
SO8093902	58.82	57.36	54.56	C	VC	C	150	nil	14.01	nil	SO8112823	25.00	24.90	24.90	F	U	C	nil	nil	26.46	nil
SO8093903	66.82	64.93	62.45	C	VC	C	150	nil	11.55	nil	SO8112824	25.10	25.00	25.00	F	U	C	nil	nil	52.49	nil
SO8098802	68.78	65.73	64.86	C	VC</																





Sewer Node	Sewer Pipe Data									
REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SOB112889	nil	25.45	24.74	S	U	C	nil	nil	14.26	nil
SOB112890	nil	25.70	25.45	S	U	C	nil	nil	63.57	nil
SOB112891	nil	25.85	25.70	S	U	C	nil	nil	67.27	nil
SOB112892	nil	25.50	24.74	S	U	C	nil	nil	11.54	nil
SOB112893	nil	25.95	24.95	S	U	C	nil	nil	76.54	nil
SOB112894	nil	25.75	25.50	S	U	C	nil	nil	30.37	nil
SOB112895	nil	25.45	24.95	S	U	C	nil	nil	4.10	nil
SOB112896	nil	25.80	25.45	S	U	C	nil	nil	20.45	nil
SOB112897	nil	25.50	24.95	S	U	C	nil	nil	13.44	nil
SOB112898	nil	24.95	24.91	S	U	C	nil	nil	64.91	nil
SOB112900	nil	26.08	25.48	F	U	C	nil	nil	79.28	nil
SOB112901	nil	27.46	25.48	F	U	C	nil	nil	148.92	nil
SOB112902	nil	27.48	25.67	F	U	C	nil	nil	74.71	nil
SOB112903	nil	27.47	25.16	S	U	C	nil	nil	171.84	nil
SOB112904	nil	27.02	25.49	S	U	C	nil	nil	169.08	nil
SOB112905	nil	27.15	25.60	S	U	C	nil	nil	168.47	nil
SOB112906	nil	27.51	26.06	S	U	C	nil	nil	77.08	nil
SOB112907	nil	26.00	25.85	F	U	C	nil	nil	54.17	nil
SOB112908	nil	26.35	25.85	F	U	C	nil	nil	31.99	nil
SOB112909	nil	25.85	25.48	F	U	C	nil	nil	25.69	nil
SOB112910	nil	26.20	26.08	F	U	C	nil	nil	71.96	nil
SOB112911	nil	25.85	25.98	F	U	C	nil	nil	17.01	nil
SOB112912	nil	26.25	25.85	F	U	C	nil	nil	39.35	nil
SOB112913	nil	25.80	25.08	F	U	C	nil	nil	10.68	nil
SOB112914	nil	26.45	25.20	F	U	C	nil	nil	4.56	nil
SOB112915	nil	26.45	26.30	F	U	C	nil	nil	72.47	nil
SOB112916	nil	26.30	26.15	F	U	C	nil	nil	75.82	nil
SOB112917	nil	26.15	25.85	F	U	C	nil	nil	77.09	nil
SOB112918	nil	25.85	25.75	F	U	C	nil	nil	65.77	nil
SOB112919	nil	25.75	25.64	F	U	C	nil	nil	77.40	nil
SOB112920	nil	26.35	26.20	S	U	C	nil	nil	54.33	nil
SOB112921	nil	26.20	25.16	S	U	C	nil	nil	9.82	nil
SOB112922	nil	26.65	26.20	S	U	C	nil	nil	29.86	nil
SOB112923	nil	27.93	25.66	S	U	C	nil	nil	92.65	nil
SOB112924	nil	25.90	25.68	S	U	C	nil	nil	59.28	nil
SOB112925	nil	27.93	26.45	S	U	C	nil	nil	10.08	nil
SOB112926	nil	26.50	26.45	S	U	C	nil	nil	67.88	nil
SOB112927	nil	26.70	26.50	S	U	C	nil	nil	51.18	nil
SOB112928	nil	26.65	26.70	S	U	C	nil	nil	65.13	nil
SOB112929	nil	26.60	26.06	S	U	C	nil	nil	30.64	nil
SOB112930	nil	26.70	26.60	S	U	C	nil	nil	61.25	nil
SOB112931	nil	26.80	26.70	S	U	C	nil	nil	82.86	nil
SOB112932	nil	26.50	26.25	S	U	C	nil	nil	68.73	nil
SOB112933	nil	26.55	26.20	S	U	C	nil	nil	48.76	nil
SOB112934	nil	26.20	25.60	S	U	C	nil	nil	10.39	nil
SOB112935	nil	26.25	26.10	S	U	C	nil	nil	66.02	nil
SOB112936	nil	26.10	25.49	S	U	C	nil	nil	10.66	nil
SOB112937	nil	26.55	26.45	S	U	C	nil	nil	50.64	nil
SOB112938	nil	26.65	26.45	S	U	C	nil	nil	51.82	nil
SOB112939	nil	26.45	26.15	S	U	C	nil	nil	16.81	nil
SOB112940	nil	26.15	25.49	S	U	C	nil	nil	14.77	nil
SOB112941	nil	26.88	24.63	24.67	F	U	C	nil	170.81	nil
SOB112942	nil	26.76	24.71	24.63	F	U	C	nil	154.05	nil
SOB112943	nil	26.78	24.85	24.71	F	U	C	nil	151.32	nil
SOB112944	nil	26.66	24.84	24.85	F	U	C	nil	154.21	nil
SOB112945	nil	26.68	24.94	24.94	F	U	C	nil	152.58	nil
SOB112946	nil	27.20	25.20	25.08	F	U	C	nil	153.49	nil
SOB112947	nil	27.03	24.57	24.32	F	U	C	nil	143.98	nil
SOB112948	nil	26.70	24.40	23.98	F	U	C	nil	92.86	nil
SOB112949	nil	26.86	24.18	23.20	S	U	C	nil	10.01	nil
SOB112950	nil	27.01	23.20	23.09	S	U	C	nil	402.87	nil
SOB112951	nil	26.76	24.23	24.18	S	U	C	nil	244.36	nil
SOB112952	nil	26.78	25.19	24.31	S	U	C	nil	25.34	nil
SOB112953	nil	26.89	25.36	25.19	S	U	C	nil	71.26	nil
SOB112954	nil	26.70	24.75	23.05	S	U	C	nil	25.02	nil
SOB112955	nil	25.90	25.50	F	U	C	nil	nil	77.51	nil
SOB112956	nil	25.70	25.00	F	U	C	nil	nil	12.59	nil
SOB112957	nil	25.55	25.25	F	U	C	nil	nil	71.78	nil
SOB112958	nil	25.95	25.65	F	U	C	nil	nil	10.37	nil
SOB112959	nil	25.80	25.65	F	U	C	nil	nil	72.70	nil
SOB112960	nil	25.25	25.15	F	U	C	nil	nil	49.44	nil
SOB112961	nil	25.15	25.00	F	U	C	nil	nil	25.15	nil
SOB112962	nil	25.50	24.63	F	U	C	nil	nil	21.78	nil
SOB112963	nil	25.65	24.71	F	U	C	nil	nil	39.52	nil
SOB112964	nil	25.50	24.57	F	U	C	nil	nil	7.19	nil
SOB112965	nil	25.00	24.67	F	U	C	nil	nil	21.36	nil
SOB112966	nil	25.65	24.85	F	U	C	nil	nil	10.26	nil
SOB112967	nil	26.75	25.65	F	U	C	nil	nil	6.07	nil
SOB112968	nil	25.85	25.60	F	U	C	nil	nil	61.44	nil
SOB112969	nil	26.00	25.85	F	U	C	nil	nil	56.88	nil
SOB112970	nil	25.60	24.94	F	U	C	nil	nil	8.35	nil
SOB112971	nil	24.95	24.40	F	U	C	nil	nil	12.81	nil
SOB112972	nil	25.00	24.95	F	U	C	nil	nil	32.24	nil
SOB112973	nil	25.10	25.00	F	U	C	nil	nil	74.22	nil
SOB112974	nil	25.70	25.40	F	U	C	nil	nil	57.65	nil
SOB112975	nil	26.15	25.01	S	U	C	nil	nil	5.75	nil
SOB112976	nil	25.85	25.31	F	U	C	nil	nil	10.68	nil
SOB112977	nil	26.20	26.15	S	U	C	nil	nil	130.33	nil
SOB112978	nil	26.15	25.30	S	U	C	nil	nil	68.15	nil
SOB112979	nil	25.90	25.36	S	U	C	nil	nil	11.49	nil
SOB112980	nil	25.95	25.19	S	U	C	nil	nil	7.26	nil
SOB112981	nil	26.15	25.95	S	U	C	nil	nil	60.92	nil
SOB112982	nil	26.20	25.95	S	U	C	nil	nil	13.79	nil
SOB112983	nil	25.95	24.31	S	U	C	nil	nil	5.91	nil
SOB112984	nil	26.10	25.95	S	U	C	nil	nil	72.05	nil

Sewer Node	Sewer Pipe Data									
REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SOB112985	nil	26.00	25.70	S	U	C	nil	nil	31.15	nil
SOB112986	nil	25.85	25.70	S	U	C	nil	nil	68.69	nil
SOB112987	nil	25.55	25.45	S	U	C	nil	nil	48.35	nil
SOB112988	nil	25.45	25.30	S	U	C	nil	nil	27.85	nil
SOB112989	nil	26.30	24.28	S	U	C	nil	nil	5.26	nil
SOB112990	nil	25.70	25.55	S	U	C	nil	nil	79.03	nil
SOB112991	nil	26.00	25.25	S	U	C	nil	nil	4.65	nil
SOB112992	nil	26.00	25.25	S	U	C	nil	nil	16.32	nil
SOB112993	nil	24.00	23.20	S	U	C	nil	nil	5.28	nil
SOB112994	nil	25.25	24.45	S	U	C	nil	nil	5.35	nil
SOB112995	nil	24.45	23.20	S	U	C	nil	nil	4.81	nil
SOB112996	nil	26.20	24.00	S	U	C	nil	nil	14.00	nil
SOB112997	nil	26.00	24.30	S	U	C	nil	nil	10.46	nil
SOB112998	nil	25.35	24.75	S	U	C	nil	nil	11.34	nil
SOB112999	nil	25.45	25.35	S	U	C	nil	nil	67.55	nil
SOB113000	27.08	24.32	24.24	F	U	C	nil	nil	156.54	nil
SOB113001	27.22	23.98	23.87	F	U	C	nil	nil	138.15	nil
SOB113002	27.01	23.09	23.04	S	U	C	nil	nil	132.26	nil
SOB113003	27.20	23.05	22.91	S	U	C	nil	nil	64.09	nil
SOB113004	nil	26.35	25.50	F	U	C	nil	nil	13.22	nil
SOB113005	nil	25.50	25.24	F	U	C	nil	nil	13.64	nil
SOB113006	nil	26.10	25.55	F	U	C	nil	nil	7.75	nil
SOB113007	nil	25.40	23.98	F	U	C	nil	nil	5.54	nil
SOB113008	nil	26.65	24.90	S	U	C	nil	nil	5.29	nil
SOB113009	nil	26.70	26.60	S	U	C	nil	nil	70.88	nil
SOB113010	nil	26.60	nil	S	U	C	nil	nil	0.00	nil
SOB113011	nil	26.55	24.90	S	U	C	nil	nil	4.79	nil
SOB113012	nil	24.90	24.50	S	U	C	nil	nil	8.58	nil
SOB113013	nil	24.30	23.05	S	U	C	nil	nil	5.38	nil
SOB113014	nil	27.10	26.60	F	U	C	nil	nil	29.03	nil
SOB113015	nil	26.60	26.45	F	U	C	nil	nil	53.04	nil
SOB113016	nil	26.45	26.05	F	U	C	nil	nil	74.14	nil
SOB113017	nil	26.05	25.80	F	U	C	nil	nil	75.71	nil
SOB113018	nil	25.80	25.64	F	U	C	nil	nil	41.67	nil
SOB113019	nil	26.80	26.45	S	U	C	nil	nil	76.47	nil
SOB113020	nil	26.45	26.06	S	U	C	nil	nil	75.49	nil
SOB113021	nil	26.90	26.80	S	U	C	nil	nil	58.53	nil
SOB113022	nil	26.80	26.55	S	U	C	nil	nil	77.28	nil
SOB113023	26.78	24.81	24.48	F	U	C	nil	nil	151.58	nil
SOB113024	27.02	25.08	24.81	F	U	C	nil	nil		

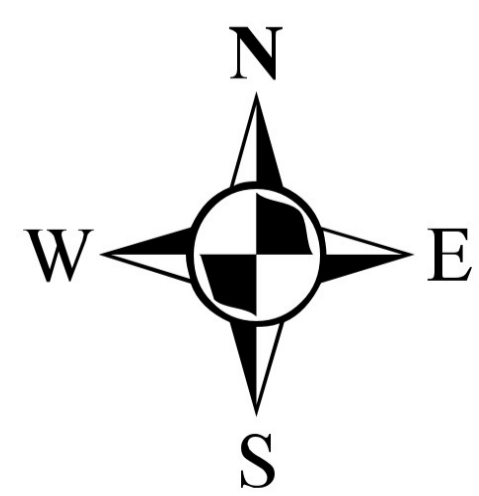



Sewer Node		Sewer Pipe Data									
REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID	
S0811912	27.94	25.28	25.05	S	U	C	525	nil	164.84	nil	
S0811913	27.53	25.05	25.02	S	U	C	525	nil	201.80	nil	
S0811914	27.44	24.95	24.88	S	U	C	600	nil	230.21	nil	
S0811915	28.12	26.14	25.32	S	U	C	225	nil	52.89	nil	
S0811916	28.16	26.66	26.22	S	U	C	150	nil	102.21	nil	
S0811917	27.17	24.88	24.82	S	U	C	600	nil	239.27	nil	
S08116900	28.67	26.84	26.62	F	U	C	150	nil	151.85	nil	
S08116901	29.19	26.98	26.84	F	U	C	150	nil	164.25	nil	
S08116902	29.07	27.57	26.98	F	U	C	100	nil	22.44	nil	
S08116903	29.05	27.63	27.39	S	U	C	150	nil	81.65	nil	
S08116904	29.20	27.24	26.93	S	U	C	300	nil	65.11	nil	
S08116905	28.66	26.93	26.54	S	U	C	300	nil	84.56	nil	
S08123000	26.65	24.41	24.39	S	U	C	750	nil	410.30	nil	
S08123001	26.65	24.39	24.35	S	U	C	750	nil	286.74	nil	
S08123002	26.25	24.35	nil	S	U	C	nil	nil	0.00	nil	
S08123003	nil	nil	nil	S	U	C	300	nil	0.00	nil	
S08123004	nil	24.39	nil	S	U	C	nil	nil	0.00	nil	
S08123005	26.65	nil	nil	F	U	C	225	nil	0.00	nil	
S08123006	26.65	24.05	24.00	F	U	C	225	nil	141.16	nil	
S08123103	26.65	24.62	24.48	S	U	C	675	nil	328.24	nil	
S08123130	nil	nil	nil	S	U	C	300	nil	0.00	nil	
S08124000	26.65	24.85	24.54	S	U	C	600	nil	152.20	nil	
S08124001	nil	nil	24.85	S	U	C	nil	nil	0.00	nil	
S08124002	nil	nil	24.85	F	U	C	nil	nil	0.00	nil	
S08124003	26.65	24.25	24.05	F	U	C	225	nil	238.24	nil	
S08124005	27.45	26.24	nil	F	U	U	nil	nil	0.00	nil	
S08124006	27.04	26.12	nil	F	U	U	nil	nil	0.00	nil	
S08124007	27.39	25.69	25.52	F	U	C	150	nil	147.50	nil	
S08124008	27.37	25.00	24.92	S	U	C	375	nil	293.64	nil	
S08125000	28.18	26.65	26.29	F	U	C	100	nil	73.43	nil	
S08125001	27.75	26.24	25.96	F	U	C	150	nil	152.27	nil	
S08125002	27.23	25.96	25.87	F	U	C	150	nil	123.88	nil	
S08125003	27.34	25.87	25.81	F	U	C	150	nil	171.98	nil	
S08125004	27.57	25.81	25.69	F	U	C	150	nil	148.76	nil	
S08125005	27.89	26.39	25.86	F	U	C	100	nil	69.63	nil	
S08125006	27.97	26.67	26.39	F	U	C	100	nil	24.24	nil	
S08125007	28.35	26.59	26.43	F	U	C	150	nil	153.49	nil	
S08125008	28.17	26.64	25.67	S	U	C	150	nil	20.65	nil	
S08125009	27.89	25.78	25.67	S	U	C	150	nil	95.19	nil	
S08125010	27.80	25.59	25.34	S	U	C	225	nil	189.38	nil	
S08125011	27.29	25.34	25.29	S	U	C	225	nil	198.49	nil	
S08125012	27.39	25.29	25.22	S	U	C	225	nil	167.65	nil	
S08125013	27.59	25.07	25.00	S	U	C	375	nil	309.65	nil	
S08125014	27.92	26.38	25.14	S	U	C	300	nil	25.77	nil	
S08125015	28.00	26.50	26.45	S	U	C	225	nil	160.92	nil	
S08125016	28.24	26.92	26.50	S	U	C	225	nil	57.63	nil	
S08125017	28.38	27.07	26.92	S	U	C	225	nil	70.29	nil	
S08125018	27.42	26.75	nil	S	U	U	nil	nil	0.00	nil	
S08126000	28.85	26.81	26.59	F	U	C	150	nil	148.55	nil	
S08126001	28.89	27.42	27.07	S	U	C	225	nil	91.22	nil	

- X — X — Abandoned Sewer
- Private Combined Gravity Sewer
- Private Foul Gravity Sewer
- Private Surface Water Gravity Sewer
- Public Combined Gravity Sewer
- Public Foul Gravity Sewer
- Public Surface Water Gravity Sewer
- Trunk Combined Gravity Sewer
- Trunk Foul Use Gravity Sewer
- Trunk Surface Water Gravity Sewer
- Combined Use Pressurised Sewer
- Foul Use Pressurised Sewer
- Surface Water Pressurised Sewer
- Highway Drain
- Combined Lateral Drain (SS)
- Foul Lateral Drain (SS)
- Surface Water Lateral Drain (SS)
- Cable, Earthing
- Cable Junction
- Cable, Optical Fibre/Instrumentation
- Cable, Low Voltage
- Cable, High Voltage
- Cable, Other
- [B] Housing, Building
- [K] Housing, Kiosk
- [LS] Disposal Site
- [STW] Sewage Treatment Works
- [●] Housing, Other
- [ ] Pipe Support Structure
- [▲] Sewage Pumping Facility
- [ ] Sewer Facility Connection Inlet / Outlet
- [■] Blind Shaft
- [●] Combined Use Manhole
- [○] Flushing Chamber
- [●] Foul Use Manhole
- [●] Grease Trap
- [+ ] Head Node
- [— ] Hydrobrake
- [○] Lamphole
- [ ] Outfall
- [ ] Overflow
- [ ] Penstock
- [○] Petrol Interceptor
- [— ] Sewer Chemical Injection Point
- [•] Sewer Junction
- [◆] Sewerage Air Valve
- [ ] Sewerage Hatch Box Point
- [— ] Sewerage Isolation Valve
- [⊙] Soakaway
- [○] Surface Water Manhole
- [ ] Vent Column
- [ ] Waste Water Storage
- [ ] Culverted Watercourse
- [— + — + — + — + — + — + ] Pre-1937 Properties

- ### MATERIALS
- AC - ASBESTOS CEMENT
  - BR - BRICK
  - CC - CONCRETE BOX CULVERT
  - CI - CAST IRON
  - CO - CONCRETE
  - CSB - CONCRETE SEGMENTS (BOLTED)
  - CSU - CONCRETE SEGMENTS (UNBOLTED)
  - DI - DUCTILE IRON
  - GRC - GLASS REINFORCED CONCRETE
  - MAC - MASONRY IN REGULAR COURSES
  - MAR - MASONRY RANDOMLY COURSED
  - PE - POLYETHYLENE
  - PF - PITCH
  - PP - POLYPROPYLENE
  - PSC - PLASTIC STEEL COMPOSITE
  - PVC - POLYVINYL CHLORIDE
  - RPM - REINFORCED PLASTIC MATRIX
  - SI - SPUN (GREY) IRON
  - XXX - OTHER
- ### CATEGORIES
- W - WEIR
  - C - CASCADE
  - DB - DAMBOARD
  - SE - SIDE ENTRY
  - FV - FLAP VALVE
  - BD - BACK DROP
  - S - SIPHON
  - HD - HIGHWAY DRAIN
  - S104 - SECTION 104
  - C - CIRCULAR
  - E - EGG SHAPED
  - O - OTHER
  - R - RECTANGLE
  - S - SQUARE
  - T - TRAPEZOIDAL
  - U - UNKNOWN
- ### PURPOSE
- C - COMBINED
  - E - FINAL EFFLUENT
  - F - FOUL
  - L - SLUDGE
  - S - SURFACE WATER

- ### TABULAR KEY
- A. Sewer pipe data refers to downstream sewer pipe.
  - B. Where the node bifurcates (splits) X and Y indicates downstream sewer pipe.
  - C. Gradient is stated a 1 in...
- All Private Sewers are shown in magenta  
 All section 104 sewers are shown in green  
 All Sewers that have been transferred to Severn Trent Water after the 1<sup>st</sup> October 2011, but have not been surveyed and confirmed by Severn Trent Water are shown in orange





**Severn Trent Water Limited**  
 Asset Data Management  
 PO Box 5344  
 Coventry  
 CV3 9FT  
 Telephone: 0845 601 6616


## SEWER RECORD (TABULAR)

**O/S Map** 1:7500  
**Scale:**  
**Date of issue:** 13.07.20  
**Sheet No.** 3 of 3

This map is centred upon:  
 O / S Grid reference:  
**x :** 380407  
**y :** 210543

**Disclaimer Statement:**  
 1. Do not scale off this Map.  
 2. This map and any information supplied with it is furnished as a general guide, is only valid at the date of issue and no warranty as to its correctness is given or implied. In particular this Map and any information shown on it must not be relied upon in the event of any development or works (including but not limited to excavations) in the vicinity of Severn Trent Water's assets or for the purposes of determining the suitability of a point of connection to the sewerage or distribution systems.  
 3. On 1 October 2011 most private sewers and private lateral drains in Severn Trent Water's sewerage area, which were connected to a public sewer as at 1 July 2011, transferred to the ownership of Severn Trent Water and became public sewers and public lateral drains. A further transfer takes place on 1 October 2012 (date to be confirmed). Private pumping stations, which form part of these sewers or lateral drains, will transfer to the ownership of Severn Trent Water on or before 1 October 2016. Severn Trent Water does not possess complete records of these assets.  
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## Appendix G – QBAR Greenfield Runoff Rate

RPS Group Plc		Page 1
Highfield House Quinton Business Park Birmingham B32 1AF	Land off Gloucester Road Gloucester QBAR	
Date 03/07/2020 File	Designed by <span style="background-color: black; color: black;">██████</span> Checked by	
Micro Drainage	Source Control 2020.1	

ICP SUDS Mean Annual Flood

Input

Return Period (years) 100 SAAR (mm) 741 Urban 0.000  
Area (ha) 1.000 Soil 0.400 Region Number Region 4

**Results 1/s**


QBAR Rural 3.6  
QBAR Urban 3.6  
  
Q100 years 9.3  
  
Q1 year 3.0  
Q30 years 7.1  
Q100 years 9.3

## Appendix H – Preliminary MicroDrainage Calculations

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	100.262	0.262	42.4	2622.4	O K
30 min Summer	100.352	0.352	43.2	3515.2	O K
60 min Summer	100.449	0.449	43.2	4486.8	O K
120 min Summer	100.551	0.551	43.2	5506.8	O K
180 min Summer	100.609	0.609	43.2	6093.4	O K
240 min Summer	100.648	0.648	43.2	6484.0	O K
360 min Summer	100.698	0.698	43.2	6979.7	O K
480 min Summer	100.732	0.732	43.2	7319.0	Flood Risk
600 min Summer	100.756	0.756	43.2	7557.4	Flood Risk
720 min Summer	100.773	0.773	43.2	7725.0	Flood Risk
960 min Summer	100.792	0.792	43.2	7919.7	Flood Risk
1440 min Summer	100.799	0.799	43.2	7991.6	Flood Risk
2160 min Summer	100.786	0.786	43.2	7855.7	Flood Risk
2880 min Summer	100.766	0.766	43.2	7661.6	Flood Risk
4320 min Summer	100.716	0.716	43.2	7155.9	Flood Risk
5760 min Summer	100.661	0.661	43.2	6606.7	O K
7200 min Summer	100.607	0.607	43.2	6070.7	O K
8640 min Summer	100.556	0.556	43.2	5560.9	O K
10080 min Summer	100.509	0.509	43.2	5094.9	O K
15 min Winter	100.294	0.294	42.8	2940.3	O K
30 min Winter	100.394	0.394	43.2	3943.4	O K
60 min Winter	100.504	0.504	43.2	5037.5	O K
120 min Winter	100.619	0.619	43.2	6190.6	O K
180 min Winter	100.686	0.686	43.2	6860.1	O K
240 min Winter	100.731	0.731	43.2	7310.8	Flood Risk


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	118.165	0.0	2094.3	26
30 min Summer	79.488	0.0	2755.0	41
60 min Summer	51.110	0.0	4329.9	70
120 min Summer	31.795	0.0	5274.2	130
180 min Summer	23.759	0.0	5805.1	190
240 min Summer	19.197	0.0	6146.0	248
360 min Summer	14.105	0.0	6535.8	368
480 min Summer	11.340	0.0	6715.4	486
600 min Summer	9.566	0.0	6736.6	606
720 min Summer	8.321	0.0	6656.2	726
960 min Summer	6.671	0.0	6452.2	964
1440 min Summer	4.876	0.0	6061.8	1440
2160 min Summer	3.557	0.0	11044.4	1776
2880 min Summer	2.840	0.0	11450.9	2160
4320 min Summer	2.064	0.0	11342.3	2940
5760 min Summer	1.644	0.0	14205.8	3744
7200 min Summer	1.377	0.0	14872.1	4536
8640 min Summer	1.190	0.0	15432.2	5280
10080 min Summer	1.054	0.0	15806.4	6056
15 min Winter	118.165	0.0	2335.9	26
30 min Winter	79.488	0.0	3027.3	41
60 min Winter	51.110	0.0	4807.1	70
120 min Winter	31.795	0.0	5813.9	128
180 min Winter	23.759	0.0	6341.4	186
240 min Winter	19.197	0.0	6637.9	246

RPS Group Plc		Page 2
Highfield House Quinton Business Park Birmingham B32 1AF	Eastern Parcel Land off Gloucester Road Attenuation Volume	
Date 25/09/2020 File AAC5655 - EASTERN PARCEL.SRCX	Designed by [REDACTED] Checked by	
Micro Drainage	Source Control 2020.1	

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m <sup>3</sup> )	Status
360 min Winter	100.789	0.789	43.2	7891.2	Flood Risk
480 min Winter	100.829	0.829	43.2	8286.9	Flood Risk
600 min Winter	100.856	0.856	43.2	8562.9	Flood Risk
720 min Winter	100.876	0.876	43.2	8760.7	Flood Risk
960 min Winter	100.901	0.901	43.2	9005.6	Flood Risk
1440 min Winter	100.916	0.916	43.2	9155.3	Flood Risk
2160 min Winter	100.899	0.899	43.2	8986.5	Flood Risk
2880 min Winter	100.872	0.872	43.2	8718.2	Flood Risk
4320 min Winter	100.808	0.808	43.2	8076.3	Flood Risk
5760 min Winter	100.727	0.727	43.2	7268.1	Flood Risk
7200 min Winter	100.641	0.641	43.2	6413.0	O K
8640 min Winter	100.562	0.562	43.2	5617.5	O K
10080 min Winter	100.490	0.490	43.2	4904.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Time-Peak (mins)
360 min Winter	14.105	0.0	6859.3	362
480 min Winter	11.340	0.0	6827.6	478
600 min Winter	9.566	0.0	6734.4	596
720 min Winter	8.321	0.0	6642.9	710
960 min Winter	6.671	0.0	6471.1	940
1440 min Winter	4.876	0.0	6163.8	1386
2160 min Winter	3.557	0.0	12123.0	2008
2880 min Winter	2.840	0.0	12358.9	2260
4320 min Winter	2.064	0.0	11512.4	3200
5760 min Winter	1.644	0.0	15910.2	4096
7200 min Winter	1.377	0.0	16657.6	4904
8640 min Winter	1.190	0.0	17284.4	5704
10080 min Winter	1.054	0.0	17697.4	6456

RPS Group Plc		Page 3
Highfield House Quinton Business Park Birmingham B32 1AF	Eastern Parcel Land off Gloucester Road Attenuation Volume	
Date 25/09/2020 File AAC5655 - EASTERN PARCEL.SRCX	Designed by [REDACTED] Checked by	
Micro Drainage	Source Control 2020.1	

Rainfall Details


Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.100	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 12.007

Time (mins)		Area	Time (mins)		Area	Time (mins)		Area
From:	To:	(ha)	From:	To:	(ha)	From:	To:	(ha)
0	4	4.002	4	8	4.002	8	12	4.002



RPS Group Plc		Page 4
Highfield House	Eastern Parcel	
Quinton Business Park Birmingham B32 1AF	Land off Gloucester Road Attenuation Volume	
Date 25/09/2020	Designed by [REDACTED]	
File AAC5655 - EASTERN PARCEL.SRCX	Checked by	
Micro Drainage	Source Control 2020.1	

Model Details

Storage is Online Cover Level (m) 101.000

Tank or Pond Structure

Invert Level (m) 100.000

Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )
0.000	10000.0	1.000	10000.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0276-4320-1050-4320
Design Head (m)	1.050
Design Flow (l/s)	43.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	276
Invert Level (m)	99.950
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.050	43.2	Kick-Flo®	0.801	37.9
Flush-Flo™	0.430	43.2	Mean Flow over Head Range	-	35.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

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	8.7	0.800	38.0	2.000	58.9	4.000	82.5	7.000	108.3
0.200	28.4	1.000	42.2	2.200	61.7	4.500	87.3	7.500	112.1
0.300	42.2	1.200	46.1	2.400	64.4	5.000	91.9	8.000	115.6
0.400	43.2	1.400	49.6	2.600	66.9	5.500	96.3	8.500	119.1
0.500	43.0	1.600	52.9	3.000	71.7	6.000	100.5	9.000	122.5
0.600	42.2	1.800	56.0	3.500	77.3	6.500	104.5	9.500	125.8