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Client: Mr Richard Tyre

Flood Risk and Sustainable Drainage
Assessment for the Proposed
Development at 1 Trinity Vicarage
Road, Hinckley, Leicestershire

August 2018

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Flood Risk and Sustainable Drainage
Assessment for the Proposed Development at 1
Trinity Road, Hinckley, Leicestershire

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1 Scope of Appraisal

Herrington Consulting has been commissioned by Mr Richard Tyre to prepare a Flood Risk and Sustainable Drainage (SuDS) Assessment for the proposed development at **1 Trinity Vicarage Road, Hinckley, Leicestershire, LE10 0BU**.

A Flood Risk Assessment (FRA) appraises the risk of flooding to development at a site-specific scale and recommends appropriate mitigation measures to reduce the impact of flooding to both the site and the surrounding area. New development has the potential to increase the risk of flooding to neighbouring sites and properties through increased surface water runoff and as such, an assessment of the proposed site drainage can help to accurately quantify the runoff rates, flow pathways and infiltration potential at the site. This assessment considers the practicality of incorporating Sustainable Drainage Systems (SuDS) into the scheme design, with the aim of reducing the risk of flooding by actively managing surface water runoff.

This report has been prepared to support a full planning application and has been prepared in accordance with the requirements of both national and local planning policy. To ensure that due account is taken of industry best practice, reference has also been made to CIRIA Report C753 'The SuDS Manual' and any relevant local planning policy guidance. The surface water assessment included within this report is not intended to constitute a detailed drainage design.

2 Background Information

2.1 Site Location and Existing Use

The site is located at OS coordinates 442420, 293863 off Trinity Vicarage Road in Hinckley and covers an area of approximately 712m². The location of the site in relation to the surrounding area is shown in Figure 2.1.



Figure 2.1 – Location map (Contains Ordnance Survey data © Crown copyright and database right 2018).

The site is currently derelict and was previously occupied by a former factory building.

2.2 Site Geology and Topography

Reference to the British Geological Survey (BGS) data identifies that the geology at the site comprises Mercia Mudstone bedrock, overlaid with Diamicton superficial deposits.

Reference to aerial height data indicates that land levels at the site vary between 116.5 – 118.1m AODN, with a gradual fall towards the southeast.

2.3 Proposed Development

The development proposals are to demolish the existing factory and the erection of 13 new flats including car parking.

Further drawings of the proposed scheme are included in Appendix A.1 of this report.

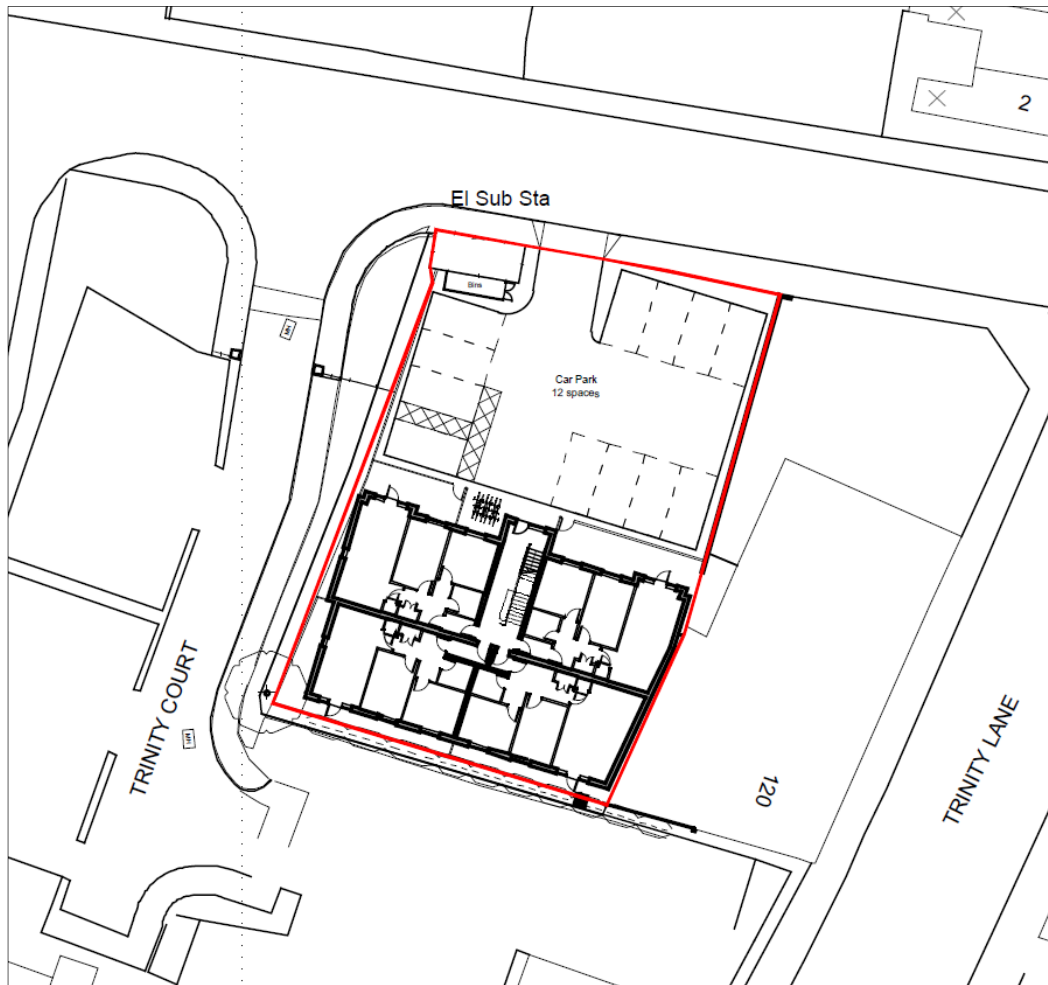


Figure 2.2 – Proposed Development Plan.

The important characteristics of the site that have the potential to influence the surface water drainage strategy are summarised in Table 2.1 below.

Site characteristic	Existing site	Proposed development
Total area of site		712 m ²
Current site condition		Brownfield
Infiltration coefficient	0.001-0.01 m/hr (assumed based on underlying geology and typical soil conditions and ground water level).	
Current surface water discharge method	The development drains into the sewer system.	
Is there a watercourse within close proximity to site?		No
Impermeable area	~ 600 m ²	Roof area = 353 m ² Hardstanding = 345 m ² Total = 698 m²
Greenfield runoff rates (based on IH124 methodology)		Qbar = 0.3l/s 1 in 1 year = 0.3 l/s 1 in 30 year = 0.6 l/s 1 in 100 year = 0.8l/s

Table 2.1 – Site characteristics affecting rainfall runoff.

Based on the table above, it is evident that the development proposals will increase the total impermeable area across the site. As a result, the rate at which the surface water runoff is discharged from the site is likely to increase and consequently, measures will need to be put in place to ensure that the impact of this additional surface water runoff is appropriately managed.

2.4 Planning Policy and Context

The general requirement for all new development with respect to surface water runoff is to ensure that the runoff is managed sustainably and that the drainage solution for the development does not increase the risk of flooding at the site, or within the surrounding area.

For undeveloped greenfield sites, the impact of the proposed development will therefore require mitigation to ensure that the runoff from the site replicates the natural drainage characteristics of the pre-developed site. In the case of brownfield sites, drainage proposals are typically measured against the existing performance of the site, although it is preferable (where practicable) to provide runoff characteristics that are similar to greenfield behaviour.

The Flood and Water Management Act 2010 National Standards (Schedule 3 – paragraph 5) for design, construction, maintenance and operation of Sustainable Drainage Systems (SuDS), came

into effect from 6 April 2015 and provides additional detail and requirements not initially covered by the NPPF and are (non-statutory) National Technical SuDS Standards (NTSS).

The NTSS specify criteria to ensure sustainable drainage is included within developments of 10 dwellings or more; or equivalent non-residential, or mixed development (as set out in Article 2(1) of the Town and Country Planning (Development Management Procedure) (England) Order 2010). It is, however, recognised that SuDS should be designed to ensure that the maintenance and operation requirements are economically proportionate.

In this instance, the proposed development comprises 13 new residential units and as such, is classified as 'major development'. The NTSS will therefore apply and reference to the Standards has been made throughout the following sections of this report to ensure the principles of sustainable drainage are considered.

In addition, Leicestershire County Council is the Lead Local Flood Authority (LLFA) and statutory consultee for major developments within Hinckley and Bosworth Borough. In accordance with the NTSS and National Planning Policy, it is imperative that the use of Sustainable Drainage Systems (SuDS) is used to ensure that developments do not increase the risk of flooding. The joint Strategic Flood Risk Assessment (SFRA) for Hinkley and Bosworth Borough Council, states that all development should have suitable and adequate SuDS to manage post-development and surface water runoff rates and volumes.

2.5 Climate Change

The global climate is constantly changing, but it is widely recognised that we are now entering a period of accelerating change. Over the last few decades there have been numerous studies into the impact of potential futures changes in the climate and there is now an increasing body of scientific evidence which supports the fact that the global climate is changing as a result of human activity. Past, present, and future emissions of greenhouse gases are expected to cause significant global climate change during this century.

The nature of climate change at a regional level will vary: for the UK, projections of future climate change indicate that more frequent short-duration, high-intensity rainfall, and more frequent periods of long-duration rainfall (of the type responsible for the recent UK flooding) could be expected.

These effects will tend to increase the size of flood zones associated with rivers, and the amount of flooding experienced from other inland sources. Consequently, the following section of this report takes into consideration the impacts of climate change and references the most contemporary guidance which is applicable to the development site.

To ensure that any recommended mitigation measures are sustainable and effective throughout the lifetime of the development, it is necessary to base the appraisal on climate change predictions which are commensurate with the planning horizon for the proposed development. The NPPF and supporting Planning Practice Guidance Suite state that residential development should be considered for a minimum of 100 years, but that the lifetime of a non-residential development

depends on the characteristics of the development. For commercial development, a 60 year design life is typically assumed. The development that is the subject of this SWMS is classified as residential, and therefore a design life of 100 years has been assumed.

Potential Changes in Climate

The recommended allowances for increases in peak rainfall intensity were updated by the Environment Agency in February 2016 and are applicable nationally. These allowances, shown in Table 2.2 below, provides a range of values which correspond with the Central and Upper End percentiles (i.e. the 50th and 90th percentile respectively) over three-time epochs.

Allowance Category (applicable nationwide)	Total potential change anticipated for each epoch		
	2015 to 2039	2040 to 2069	2070 to 2115
Upper End	+10%	+20%	+40%
Central	+5%	+10%	+20%

Table 2.2 – Recommended peak rainfall intensity allowance for small and urban catchments (1961 to 1990 baseline).

Impacts of Climate Change on the Development Site

Potential increases in future rainfall need to be considered when designing surface water drainage systems. For this development, a design life of 100 years is assumed and therefore, an increase of 20% in peak rainfall intensity has been applied to the calculations used for the design rainfall event. Where this allowance has been applied the abbreviation “+20%cc” has been used.

To test the sensitivity of the proposed surface water drainage strategy to changes in peak rainfall intensity the Environment Agency recommend testing the drainage system under a higher climate change allowance of 40%. This has been considered further within the following sections of this report.

3 Potential Sources of Flooding

In determining whether the proposals for development are compliant with the NPPF, it is necessary to determine whether the development will be sustainable in terms of flood risk. Consequently, the main sources of flooding have been assessed and are discussed in Table 3.1 below.

Source of Flooding	Evidence
Risk of Flooding from Rivers	The site is situated in Flood Zone 1 and is not located within an area identified by the Environment Agency's Flood Zone mapping as being at risk of flooding from a main river. Consequently, the risk of flooding from rivers is considered to be <i>low</i> .
Risk of Flooding from Sea/Estuaries	The site is located a significant distance inland and is elevated above predicted extreme tide levels. Consequently, the risk of flooding from this source is considered to be <i>low</i> .
Risk of Flooding from Ordinary and man-made watercourses	Inspection of OS mapping of the site and surrounding area reveals that there are no non-main rivers or artificial watercourses within close proximity to the site and therefore the risk of flooding from this source is considered to be <i>low</i> .
Risk of Flooding from Overland flow	Inspection of the Environment Agency 'Risk of Flooding from Surface Water' mapping identifies that the site is at 'very low' risk of flooding from surface water. This is supported by aerial height data which reveals that there are no topographic depressions within the site that would encourage surface water to pond. Consequently, the risk of flooding from this source is considered to be <i>low</i>. Notwithstanding this, the proposals for development should include a sustainable drainage system (SuDS) to ensure that surface water runoff is managed appropriately. These SuDS will reduce the risk of surface water flooding to the proposed development, whilst limiting the risk of flooding to the surrounding area. <i>Refer to Section 5.</i>
Risk of Flooding from Groundwater	Groundwater flooding is most likely to occur in low lying areas underlain by permeable rock (aquifers). The underlying geology in this area is Mercia Mudstone Group with overlaying superficial deposits of Oadby Member. Whilst the underlying bedrock is typically impermeable, water could flow within the more permeable superficial deposits. However, land levels fall away from the site to the south. Therefore, it is these lower lying regions to the south where groundwater emergence is more likely to occur. This is supported by mapping provided as part of the Defra Groundwater Flood Scoping Study (May 2004) which shows that no groundwater flooding events were recorded near the site during the very wet periods of 2000/01 or 2002/03. The mapping also identifies that the site itself is not located within an area where groundwater emergence is predicted. Additionally, the Hinckley and Bosworth Borough Council SFRA mapping shows the site to be located in an area at low risk of groundwater flooding. Consequently, the risk of flooding from this source is considered to be <i>low</i>.
Risk of Flooding from Sewers	Inspection of the asset location mapping provided by Seven Trent Water identifies a combined water sewer to the north and east of the site along Trinity Vicarage Road. Additionally, the Hinckley and Bosworth Borough Council SFRA and SWMP indicate the site has not been subject to historic sewer flooding. Furthermore, in the unlikely event that water was to exit the sewer in this location (i.e. as a result of an extreme pluvial event, or a blockage), floodwater is likely to comprise shallow flows, which would be contained within the highway. Inspection of aerial height data reveals that Trinity Vicarage Road slopes away to the east and as such, any floodwater will be encouraged to flow away from the site. Consequently, the risk of flooding to the site from sewers is considered to be <i>low</i> .
Risk of Flooding from Artificial Sources	Inspection of the OS mapping for the area shows that there are no artificial sources of flooding within close proximity to the site. In addition, the Environment Agency's 'Risk of Flooding from Reservoirs' website shows that the site is not within an area considered to be at risk of flooding from reservoirs and as such the risk of flooding from this source is considered to be <i>low</i> .

Table 3.1 – Assessment of the risk of flooding from all sources.

From the analysis in Table 3.1, it can be seen that the site is not exposed to any significant risks of flooding.

4 Existing Drainage

4.1 Existing Surface Water Drainage

Surface water runoff from the roof of the property drains into the public surface water sewer system on Trinity Vicarage Lane. The hardstanding area to the front of site is assumed to drain informally towards the existing carriageway.

Surface water runoff is discharged at an unrestricted rate from the existing site and this rate of discharge has been calculated for a range of rainfall events with varying return periods. These rates are outlined in Table 4.1 below. Detailed hydraulic calculations have been included within the appendices.

Return period (years)	Peak runoff from the existing site (l/s)
1	11.9
30	29.3
100	38.0

Table 4.1 - Summary of peak runoff rated for the existing site.

The total volume of water discharged from the site for the 100 year 6 hour event has also been calculated and is summarised in Table 4.2 below.

Site condition	Total volume discharged
Existing site	37.5 m ³

Table 4.2 – Total volume discharged from the 100 yr 6 hour event.

Severn Trent Water has provided sewer mapping as part of their asset location data for the site and surrounding area. An extract of this mapping is provided in Figure 4.1 below and shows the location of public sewers in close proximity to the site.

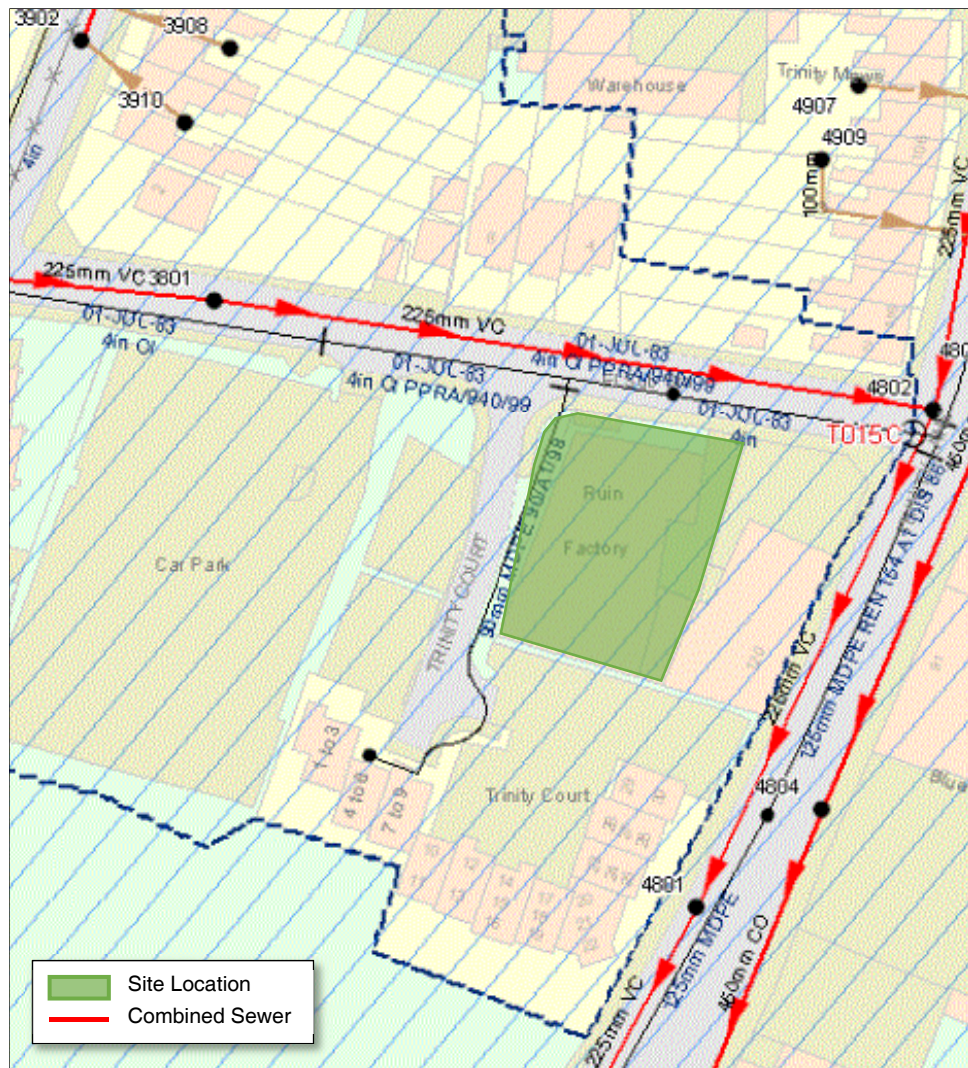


Figure 4.1 – Extract from Seven Trent Water Asset Location mapping for the area around Trinity Court.

From Figure 4.1 (above) it is evident that there are combined sewer networks in this area. The nearest combined sewer to the site is located approximately 5m to the north of the site entrance, within the adjacent road. A detailed copy of the Seven Trent Water Asset plan has been included within Appendix A.4.

5 Sustainable Drainage Assessment

5.1 Opportunities to Discharge Surface Water Runoff

Part H of the Building Regulations summarises a hierarchy of options for discharging surface water runoff from developments. The most preferential option is to **infiltrate** water into the ground, as this deals with the water at source and serves to replenish groundwater. If this option is not viable, the next option of preference is for the runoff to be discharged into a **watercourse**. Only if neither of these options are possible, the water should be conducted into the **public sewer** system.

For some sites it is recognised that under periods of high rainfall intensity, or long duration rainfall events, the saturated ground can lead to insufficient porosity, thus preventing surface water runoff from infiltrating into the ground. In these cases, a joint solution termed by CIRIA C753 as 'Type B SuDS' is often used. This approach combines infiltration with attenuation to maximise discharge at source, whilst simultaneously ensuring any runoff which is not infiltrated into the ground can instead be restricted to greenfield runoff rates.

The following opportunities for managing the surface water runoff discharged from the development site are listed in order of preference:

Infiltration – Geological records indicate that the site is positioned within the Mercia Mudstone formation and historic boreholes indicate that the groundwater table is relatively high (1.5 – 2m BGL). Typically, the site geology is a clay composition and soakage is generally impeded. Consequently, the sole use of infiltration SuDS is not considered a viable solution at this development site. However, infiltration and groundwater testing will be carried out to confirm this as part of the detailed design.

On this basis it is assumed that infiltration will not be a suitable method for discharging surface water runoff from the site, although the use of permeable paving may still be considered appropriate as a means to store surface water.

Discharge to Watercourses – There are no watercourses located within close proximity to the site which show onward connectivity to a main river, the sea, or any other large surface water body. As a result, there is no opportunity to discharge surface water runoff from the development to an existing watercourse.

Discharge to Public Sewer System – The remaining solution for draining surface water runoff from the proposed development is likely to be via the existing connection to the combined public sewer network. Providing the proposed discharge rate is less than the existing discharge rate, it is likely this will be acceptable to the sewerage undertaker (Severn Trent Water). Where an existing sewer connection is not available, a new connection will need to be made, and appropriate consent will be required from Severn Trent Water before works commence on site.

5.2 Constraints and Further Considerations

There are a number of potential constraints that should be considered as part of the drainage strategy. The key constraints that are relevant to this development are listed below:

- There is limited open space in which to incorporate SuDS features that require very large areas of land such as wetlands and large infiltration basins.
- Due to the limited infiltration at the site it will not be possible to discharge all of the surface water runoff via infiltration. Consequently, the use of Type B SuDS is recommended to minimise the volume of surface water discharged from the proposed development.
- If additional surface water runoff is to be discharged into the public sewer system, or if a new connection is required, it will be necessary to gain consent for this connection from the sewerage undertaker (Severn Trent Water).
- Ideally the discharge rate of surface water from the remainder of the site should be restricted to mimic greenfield runoff rates. Nonetheless, on small sites where discharge rates are exceptionally low (less than 2.0l/s), higher rates are generally considered acceptable. This is due to the technical limitations of flow control devices. In this case, it is likely that a discharge rate of 2.0l/s will be considered acceptable to the LLFA and LPA.

5.3 Proposed Surface Water Management Strategy

The drainage strategy which discusses each of the different elements of the proposed scheme is set out below, along with the calculations that have been undertaken to demonstrate how the overall objectives can be achieved. This does not represent a detailed surface water drainage design; it is simply an assessment to demonstrate that the objectives and requirements of the NPPF can be met at the planning stage.

Permeable Surfacing

Runoff from the hardstanding areas across the site will be directed via underground pipes into a layer of open graded subbase material, located beneath permeable surfacing. The rate at which runoff is permitted to exit the permeable surfacing system will be restricted through the use of a vortex flow control device (Hydro-Brake or similar). If ground conditions permit, the base of the permeable surfacing system can be underlain with a permeable geotextile liner to maximise the volume of water discharged to the ground via infiltration. The permeable surfacing system can contain an overflow pipe which will direct water from the top of the paving system directly into the public sewer system, in the event that the flow control device fails, or becomes blocked. Check valves should be specified to prevent backflow into the drainage system, should the public sewer system surcharge. A summary of the Causeway Flow+ Drainage analysis for permeable surfacing is shown in Table 5.1 below.

Parameter	Value (1:100yr+20%cc event)
SuDS	Permeable surfacing
Total area draining to permeable surfacing (assumed entire site area)	720 m ²
Area of permeable surfacing	~ 310 m ²
Infiltration	Permitted (although assumed negligible)
Sub-base depth	450 mm
Required storage volume	42 m ³
Flow control device	Vortex flow control device (Hydro-Brake or similar).
Limiting discharge rate	2.0l/s
Critical storm duration	120 minutes
Overflow device	Piped bypass <i>Connects directly to the public sewer system</i>

Return Period	Peak discharge rate	360 minute discharge volume
1 in 2yr+cc	2.0 l/s	9.9m ³
1 in 30yr+cc	2.0 l/s	24.9 m ³
1 in 100yr+cc	2.0 l/s	39.0 m ³

Table 5.1 – Summary of Causeway Flow+ analysis for the permeable surfacing (100 yr+20%cc), and peak discharge rates for a range of return period events (+20%cc).

It is evident that, with the inclusion of the permeable paving SuDS, there is the potential to accommodate all the surface water runoff from the site up to, and including, the design rainfall event. This assumes the rate at which water is discharged to the public sewer system will be attenuated to a rate which is no greater than 2.0l/s. The calculations have assumed that infiltration is not possible, however where soakage is available it will be infiltrated through the base of the permeable paving system.

The proposed peak runoff rates have been compared with the runoff rates from the existing site and are summarised in Table 5.2 below:

Return Period	Estimated pre-development discharge rates	Proposed peak discharge rate into pond (including 20%cc)
1 in 1yr	11.9 l/s	2.0 l/s
1 in 30yr	29.3 l/s	2.0 l/s
1 in 100yr	38.0 l/s	2.0 l/s

Table 5.2 – Summary of the existing and proposed peak discharge rates for a range of return period events.

From the table above, it is evident that the rate of discharge into the combined sewer system will be reduced considerably, when compared with existing estimated peak discharge rates. Therefore, the development will provide a significant betterment and is likely to be considered acceptable by both the LLFA and Seven Trent Water.

Water Quality

Table 26.2 of the CIRIA C753 SuDS Manual defines residential parking areas to have a low risk of pollution and is not located within the Environment Agency Source Protection Zone. Nonetheless, the simple index approach has been undertaken in assessing water quality management for the site.

The pollution hazard indices for the proposed site have been summarised in Table 5.3 below. This has been compared with the mitigation index for proposed SuDS at this site.

Parameter	Total suspended solids (TSS)	Metals	Hydro-Carbons
Pollution Hazard Index	0.5	0.4	0.4
Permeable Paving mitigation Index	0.7	0.6	0.7

Table 5.3 – CIRIA C753 simple index approach to water quality management

With reference to Table 5.3, the simple index approach to water quality management has been applied to the permeable paving system for this site, and providing that the depth of the sub-base is more than 300mm, the proposed SuDS system is greater than the pollution hazard index and will therefore be considered acceptable.

Indicative Drainage Plan

An Indicative Drainage Layout Plan has been produced showing the extent of the drainage system and typical construction details of the permeable paving system have been provided. This information is located within Appendix A.2 of this report.

5.4 Management and Maintenance

For any surface water drainage system to operate as originally designed, it is necessary to ensure that it is adequately maintained throughout its lifetime.

The key requirements of any management regime are routine inspection and maintenance, when the development is taken forward to the detailed design stage an 'owner's manual' will need to be prepared. This should include:

- A description of the drainage scheme
- A location plan showing all of the SuDS features and equipment such as flow control devices etc.
- Maintenance requirements for each element, including any manufacturer specific requirements
- An explanation of the consequences of not carrying out the specified maintenance
- Details of who will be responsible for the ongoing maintenance of the drainage system

For the SuDS recommended by this assessment, the most obvious maintenance tasks will be the regular brushing and cleaning of the permeable surfacing. Table 5.4 (below) provides details on the typical maintenance requirements. It is acknowledged that inspections and maintenance procedures are likely to be required at a higher frequency during the first few years following construction as each of the systems becomes established.

Permeable Paving/Surfacing Maintenance	
Ongoing monitoring and maintenance	- Regular brushing / vacuuming and removal of leaf litter. Recommended at least three times a year at the end of winter, mid-summer and after the autumn leaf fall. In addition, paving should be brushed when required to remove debris to avoid clogging and discourage weed growth. - Stabilise and mow all contributing and adjacent areas. - Remove weeds on a regular basis. - Repair any cracked or broken blocks as well as any blocks which may be hazardous to users or effect the structural performance of the paving. - Fix any depressions formed in the paving. - Inspect the silt accumulation rates and adjust brushing frequencies accordingly (this may vary seasonally).
Annual maintenance	- Monitor inspection chambers. - Inspect siltation rates in the sub-base.
Maintenance following storms	- Remediate any adjacent landscaping which has been raised to within 50mm of the level of the paving. - Rehabilitation of surface and upper sub-structure.
Occasional maintenance (when required)	An initial inspection is usually required around three months after installation to inspect the paving.

Table 5.4 – Typical maintenance requirements for Permeable Paving.

For developments such as this that rely to some extent on the ongoing inspection and maintenance of SuDS, it will be necessary to ensure that measures are in place to maintain the system for the lifetime of the development.

For the communal SuDS, such as the permeable paving system, it is likely that the management company responsible for maintaining the rest of the site will be tasked with the inspection and maintenance of these features. In addition, the regular inspection and desilting of the flow control device and manhole will need to be carried out.

For some elements of the drainage system such as the flow control device, it may be necessary to use specialist contractors, or arrange for the original manufacture to inspect these features. If this is the case, the management company will need to make allowances for these inspections and works to be carried out.

Further details of the maintenance and management strategy should be confirmed following the completion of a detailed drainage design for the development.

5.5 Sensitivity Testing and Residual Risk

When considering residual risk, it is necessary to consider the impact of a flood event that exceeds the design event, or the implications if the proposed drainage system was to become blocked.

To minimise the risk of the uncontrolled discharge of floodwater from the permeable surfacing system, an overflow pipe has been incorporated into the design of this drainage feature. If the primary flow control device becomes blocked, this pipe will be used to bypass the flow control device, allowing excess water to drain directly to the public sewer system.

The permeable paving system will also be kerbed to allow water to be trapped within the car park area, helping to prevent offsite flooding, e.g. if the water levels within the sub-base become too high. Flooding across this lowered area has the added benefit of providing a visual alert to residents and the management company, providing forewarning that the capacity of the drainage system has been exceeded and that a blockage of the flow control device may have occurred. This will increase the opportunity to clear the blockage before floodwater reaches properties.

Additional calculations have been undertaken to assess the performance of the drainage system under the design rainfall event, including a 40% increase in peak rainfall intensity due to climate change. These calculations are found within the appendices and show that no flooding will occur during a rainfall event with a 1 in 100 year return period, including a 40% allowance for increases in peak rainfall intensity due to climate change.

Based on the analysis above it is therefore concluded that the proposed drainage system outlined within this strategy will not result in an increased risk of flooding to properties at the site or within the surrounding area.

6 Conclusions and Recommendations

The overarching objective of this report is to appraise the proposals for the development at Trinity Vicarage Road, Hinckley to ensure that the risk of flooding to the occupants of the proposed residential units is acceptable and that the risk of flooding offsite will not increase as a result of the development proposals. This report has therefore been prepared to appraise the risk of flooding from all sources and to provide a sustainable solution for managing the surface water runoff discharged from the development site, in accordance with the NPPF and local planning policy.

As part of this assessment, the risk of flooding has been considered for a wide range of sources and it has been identified that the risk of flooding to the proposed development is low. Notwithstanding this, in order to minimise the impact that the building could have with respect to an increase in surface water runoff, the opportunities for managing surface water at the site have been further analysed.

It is concluded that the most viable solution for managing all of the surface water runoff discharged from the proposed development will be via a connection to the public surface water sewer system (located to the north of the site).

In order to restrict the rate at which surface water runoff is discharged offsite, permeable paving SuDS has been proposed. These SuDS will be used to store water onsite and maximise the water which can be infiltrated into the ground (where infiltration is available), before it is discharged to the public sewer system. A vortex flow control device has been specified to attenuate the rate at which surface water runoff is discharged from the site, limiting the rate to a maximum of 2.0l/s. This is considered to be as close as reasonably practicable to the calculated greenfield runoff rates for the site, in accordance with the National Technical SuDS Standards.

Details of the typical maintenance and management requirements for each element of the drainage system have been provided to ensure that the proposed drainage solution can be maintained and will continue to operate in perpetuity. It is, however, recommended that an “owner’s manual” containing additional product specific maintenance requirements is produced as part of the detailed design for the site.

In conclusion, it is evident that the development is at low risk of flooding and a sustainable solution for managing the surface water runoff discharged from the proposed development at 1 Trinity Vicarage Road is available. Consequently, the proposals will meet the requirements of the NPPF and local planning policy.

7 Appendices

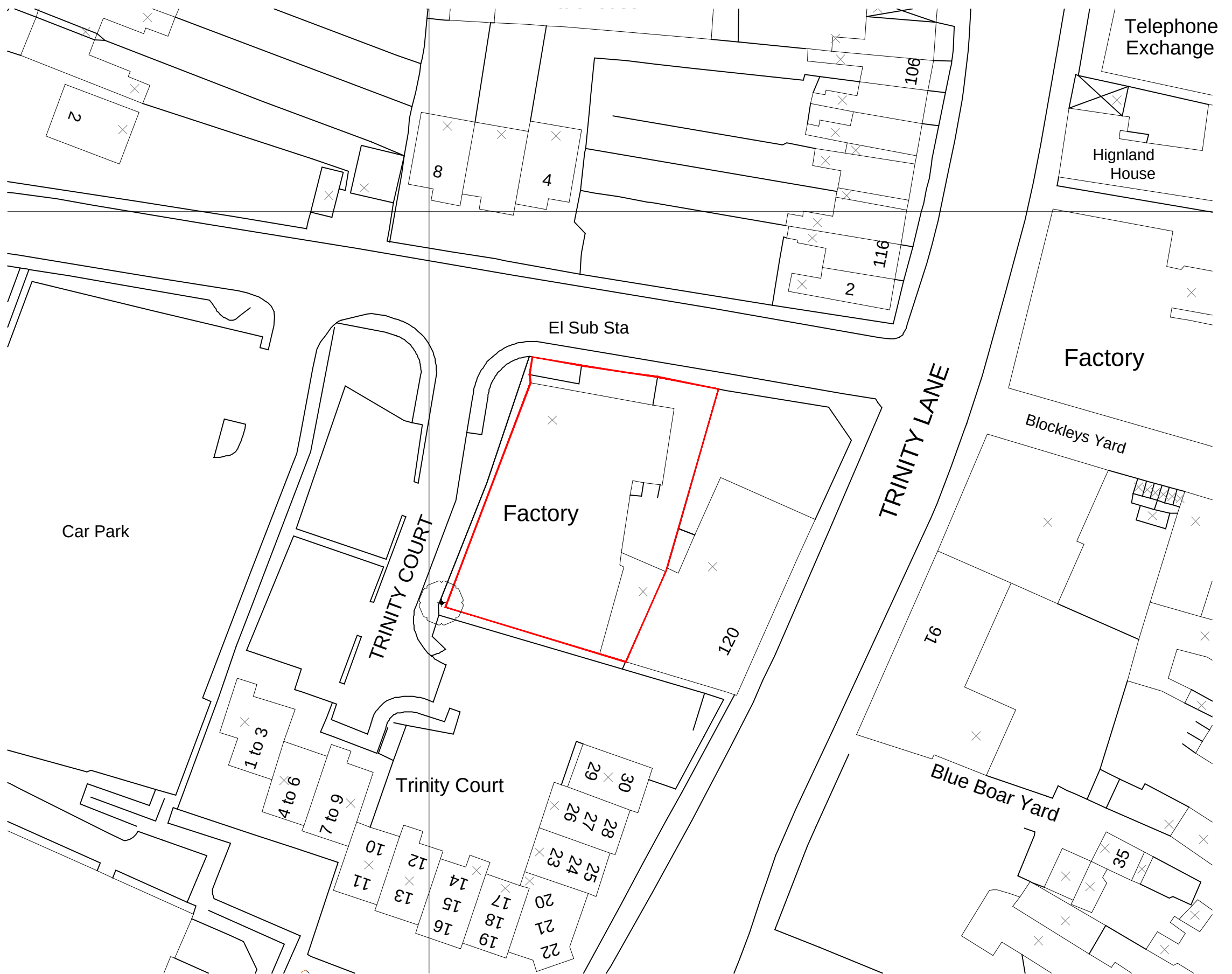
Appendix A.1 – Proposed Scheme Drawings

Appendix A.2 – Indicative Drainage Layout Plan

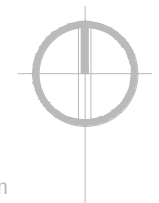
Appendix A.3 – Surface Water Management Calculations

Appendix A.4 – Seven Trent Water Asset Location Plan

Appendix A.1 – Proposed Scheme Drawings



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Do not scale from this drawing other than for planning purposes.

Contractor to check all dimensions prior to commencement on site and notify the architect of any errors, omissions or discrepancies.

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CDM Design Risk Assessment

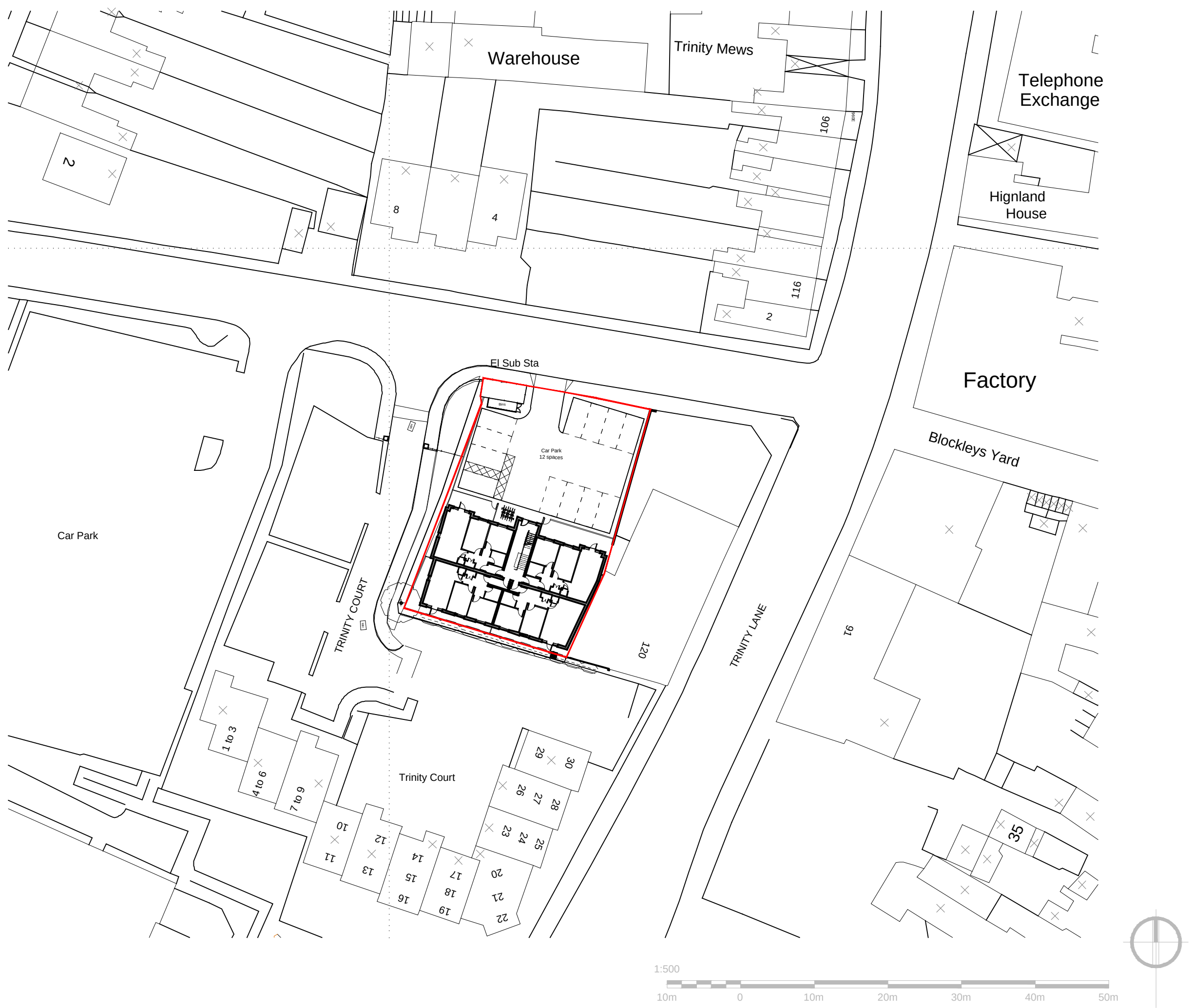
Refer to Risk Assessments/Health and Safety Plan
The following particular risks have been identified:

Notes:

00.00.00			
rev	date	description	by
PLANNING			
Residential Development Trinity Vicarage Rd, Hinckley Belvedere & Cricheley			
Location Plan As Existing			
project. no.	drp. no.	rev.	
B100	(LP)01	--	
scale	date	©	ref
1:500@A3	June '17		jem.lrg



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email: info@architectsle.co.uk



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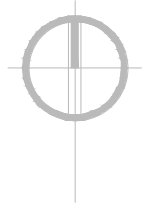
Refer to Risk Assessments/Health and Safety Plan
The following particular risks have been identified:

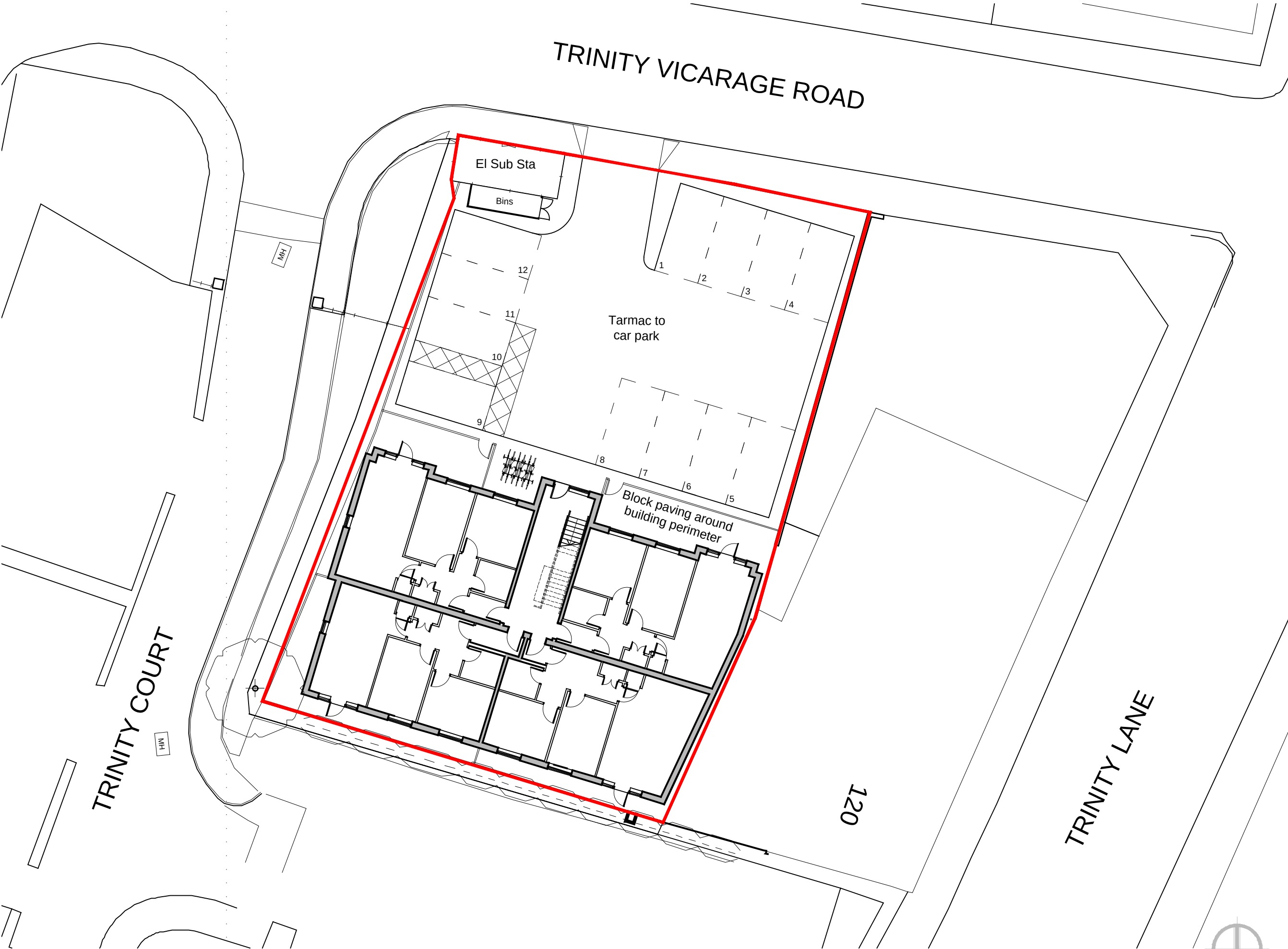
Notes:

00.00.00			
rev	date	description	by
PLANNING			
Residential Development Trinity Vicarage Rd, Hinckley Belvedere & Cricheley			
Location & Block Plan As Proposed			
project. no.	drg. no.	rev.	
B100	(LP)02	--	
scale	date	©	ref
1:500@A3	June '17		jem.lrg



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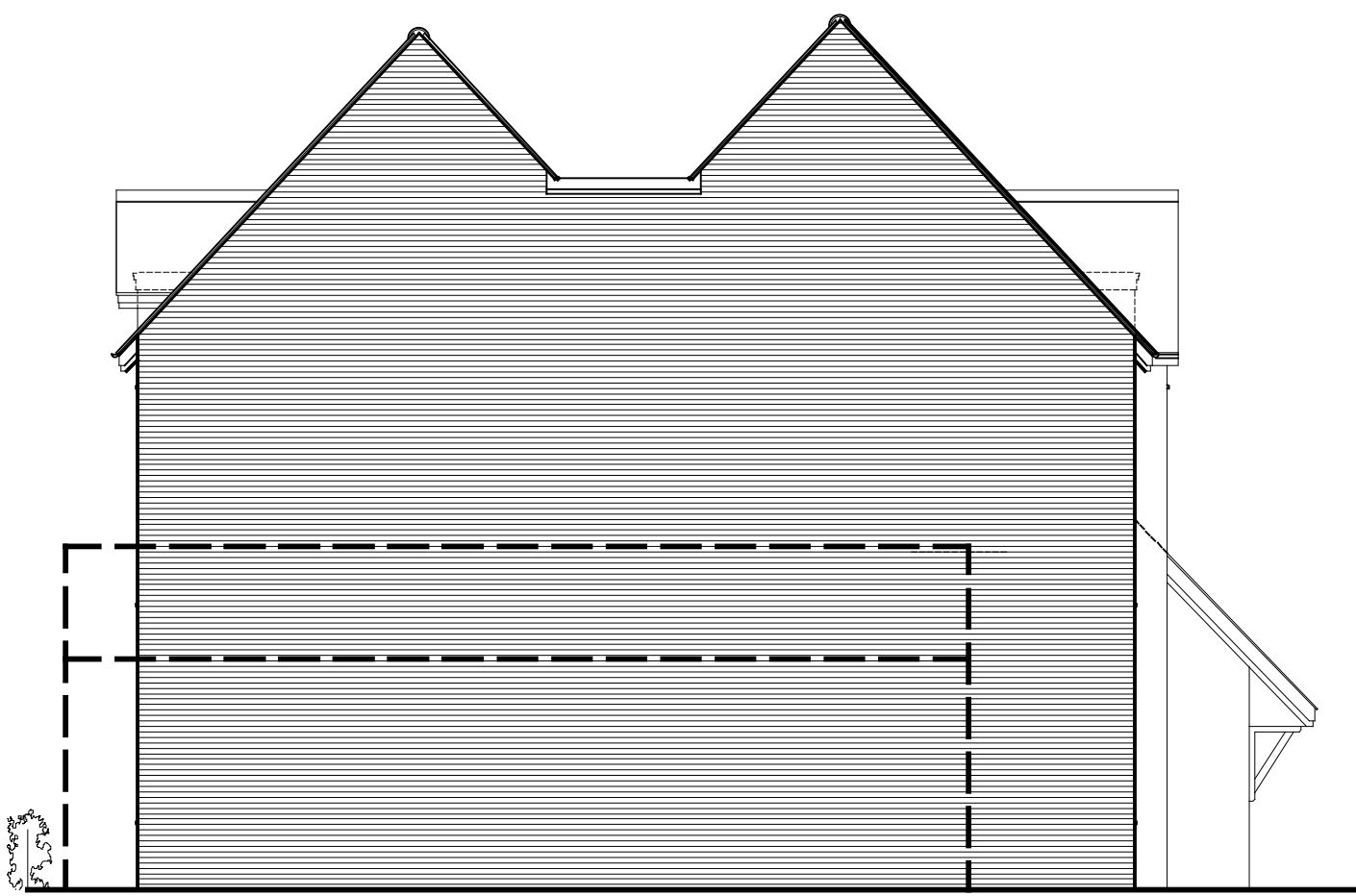
Refer to Risk Assessments/Health and Safety Plan
The following particular risks have been identified:
.
.

Notes:

00.00.00				
rev	date	description		by
PLANNING				
Residential Development Trinity Vicarage Rd, Hinckley Belvedere & Chicheley				
Landscaping As Proposed				
project. no.		drg. no.		rev.
B100		(PL) 03		--
scale	date	©	ref	
1:200@A3	June '17		jem.lrg	



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End West Elevation



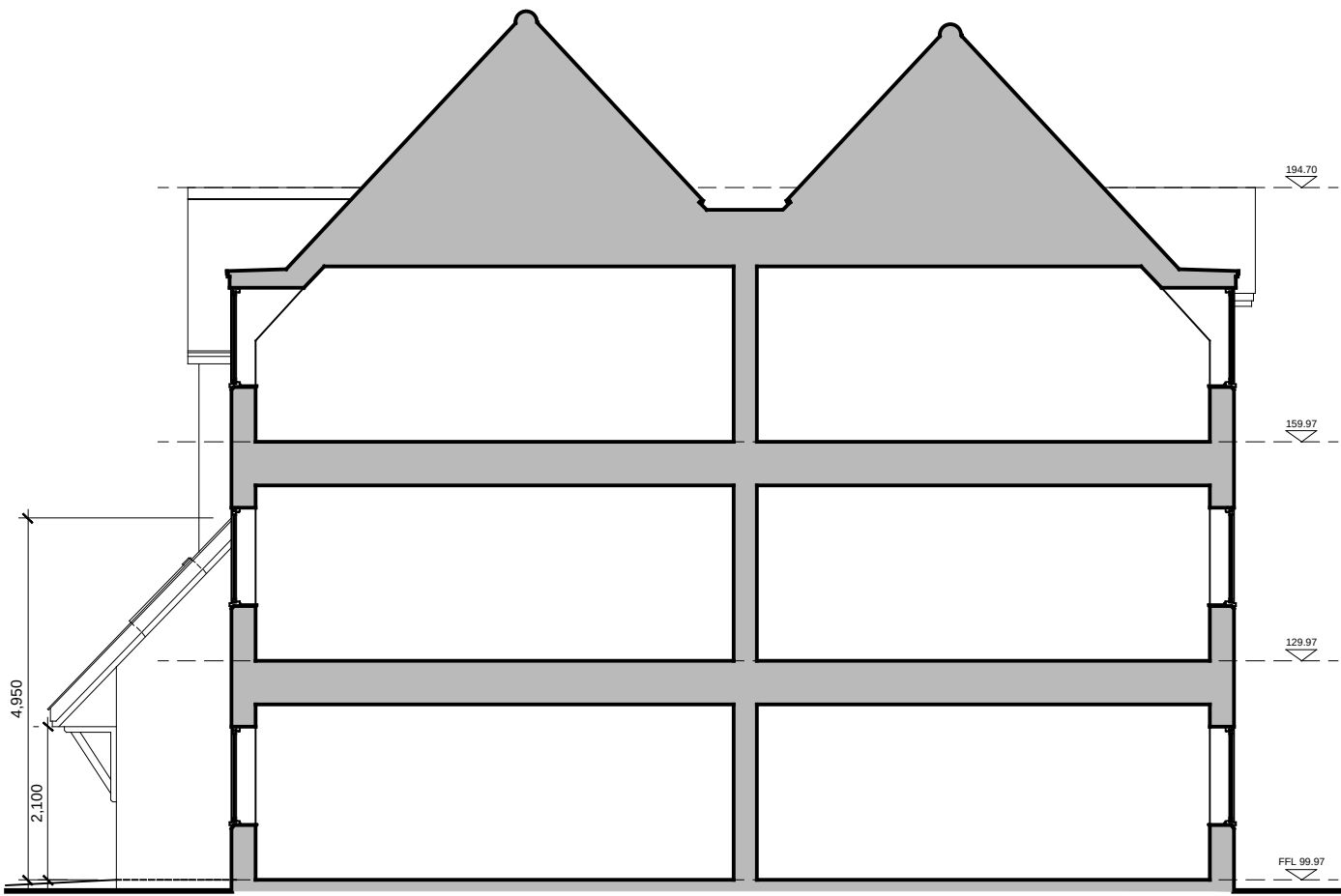
Rear South Elevation



End East Elevation

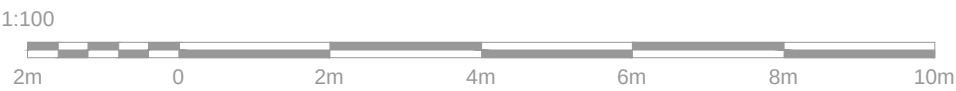


Front North Elevation



Section a-a

- MATERIALS**
- Slate Roof
 - Red clay facing brick walls with feature soldier course
 - Lead Dormers
 - PVC-U windows and doors
 - PVC-U facias and dormer gable cladding.



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Contractor to check all dimensions prior to commencement on site and notify the architect of any errors, omissions or discrepancies.

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CDM Design Risk Assessment

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The following particular risks have been identified:

-

Notes:

rev	date	description	by
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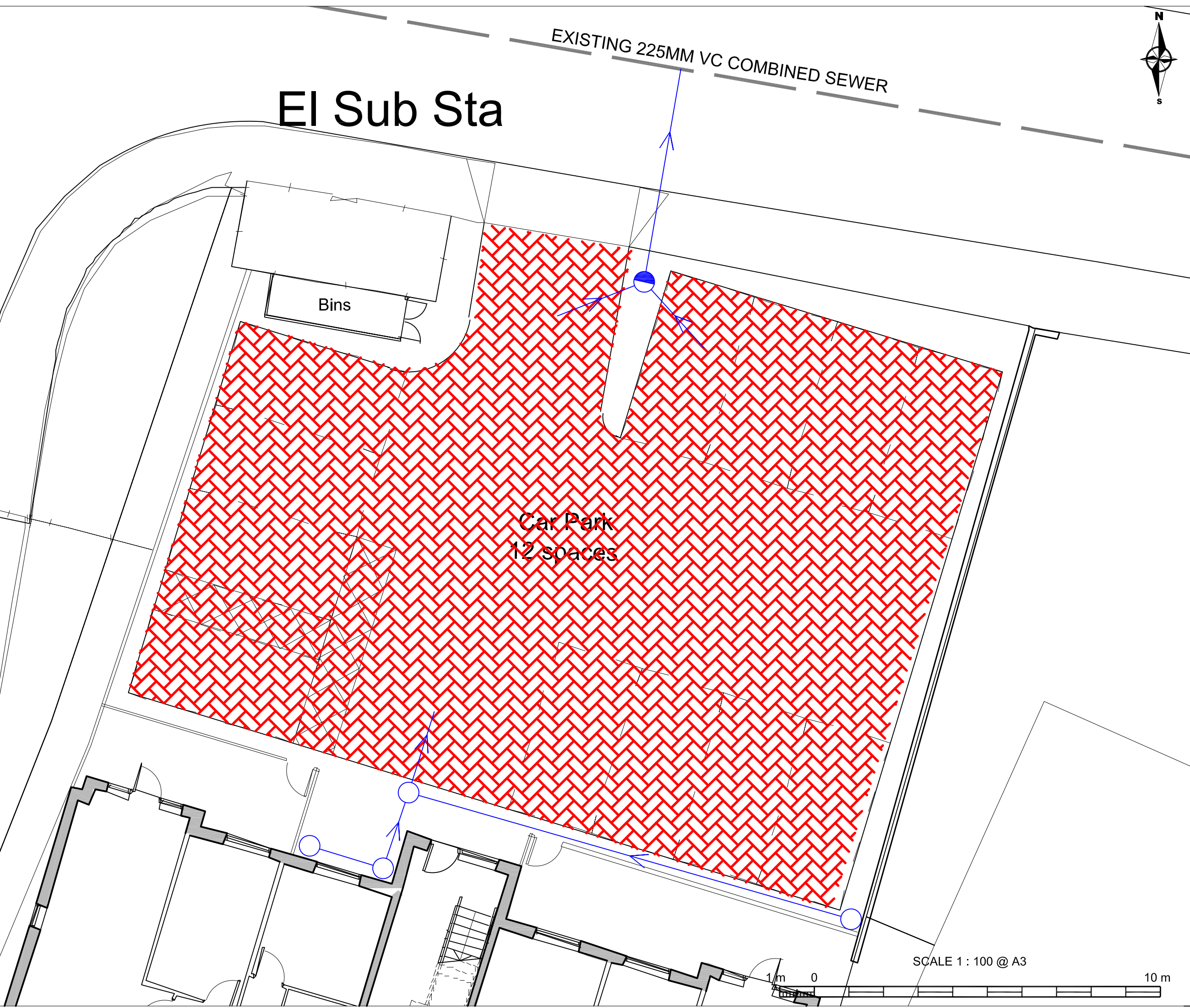
PLANNING

Residential Development
Trinity Vicarage Rd, Hinckley
Belvedere & Cricheley
Elevations and Sections

project. no.	drg. no.	rev.
B100	(PL)02	--
scale	date	© ref
1:100@A1	June '17	jem.lrg

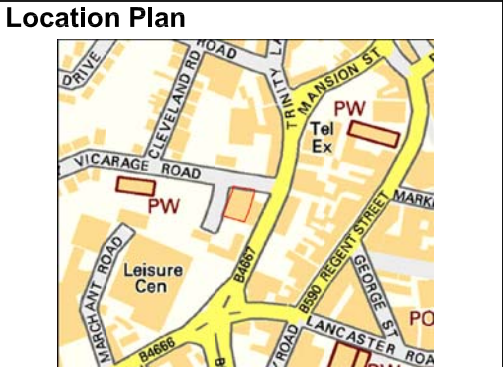
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Appendix A.2 – Indicative Drainage Layout Plan



- Key**
- Surface water manhole
 - ➔ Surface water pipeline
 - ⊖ Surface water manhole with vortex flow control device 330 x 80mm
 - ▨ Permeable paving with minimum 450mm depth of sub-base

- Notes**
1. Contains Ordnance Survey data © Crown copyright and database right 2018.
 2. All dimensions are in metres unless otherwise stated elsewhere.
 3. Proposed drainage positions will be subject to detailed design.
 4. The size and extent of the permeable paving will be subject to infiltration testing and trial holes.
 5. Connection position to existing sewer indicative and is subject to further site investigations.
 6. All drainage systems will need to be installed and designed for suitable loading requirements.



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00	First issue	20/07/2018
Rev	Description	Date
CLIENT		
MR RICHARD TYRE		
PROJECT		
SWMS - 1 TRINITY VICARAGE ROAD, HINCKLEY		
SCALE	PROJ REF	ORIGINATOR
1:100	2131	SJB
DWG REF.		CHECKED BY
INDICATIVE DRAINAGE LAYOUT		SMB
		DWG No.
		2131-01

Appendix A.3 – Surface Water Management Calculations

Calculated by: Sebastian Bures
Site name: Trinity Lane
Site location: Hinkley

Site coordinates
Latitude: 52.54112° N
Longitude: 1.37606° W

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Reference: 6404478
Date: 2018-07-19T08:34:07

Methodology

IH124

Site characteristics

Total site area (ha)	0.072
----------------------	-------

Methodology

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
SOIL type	4	4
HOST class	---	---
SPR/SPRHOST	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm)	642	642
Hydrological region	4	4
Growth curve factor: 1 year	0.83	0.83
Growth curve factor: 30 year	2	2
Growth curve factor: 100 year	2.57	2.57

Notes:

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consents are usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set in which case blockage work must be addressed by using appropriate drainage elements

(3) Is $SPR/SPRHOST \leq 0.3$?

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	0.31	0.31
1 in 1 year (l/s)	0.26	0.26
1 in 30 years (l/s)	0.63	0.63
1 in 100 years (l/s)	0.81	0.81

Scheme Title	2130 Trinity Vicarage Road
Analysis Title	Existing Site Drainage
Date	20/07/2018
Name	Sebastian Bures
Software	Causeway Flow+ V7.0



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Rainfall Methodology	FEH-99
C (1km)	-0.028
D1 (1km)	0.372
D2 (1km)	0.337
D3 (1km)	0.270
E (1km)	0.307
F (1km)	2.343
Summer CV	1.000
Winter CV	1.000
Analysis Speed	Normal
Drain Down Time (mins)	240
Additional Storage (m³/ha)	20.0

Storm Durations (mins)
15
30
60
120
180
240
360
480
600
720
960
1440

Return Period (years)	Climate Change (%)
1	0
30	0
100	0
100	20

Scheme Title	2130 Trinity Vicarage Road
Analysis Title	Existing Site Drainage
Date	20/07/2018
Name	Sebastian Bures
Software	Causeway Flow+ V7.0



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NODES

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Node Type	Manhole Type	Diameter (mm)	Width (mm)	Easting (m)	Northing (m)	Depth (m)	Notes
E.Impermeable	0.060	4.00		10.000	Manhole	Adoptable	1350		110.000	100.000	1.650	Locked
E.Outlet				9.500	Junction				120.000	100.000	2.200	Locked
E.Discharge				9.000	Junction				130.000	100.000	2.200	
P.Impermeable	0.070	4.00		10.000	Manhole	Adoptable	1900		110.000	80.000	2.200	
P.Outlet				9.500	Junction				120.000	80.000	2.200	
P.Discharge				9.000	Junction				130.000	80.000	2.200	

LINKS

Link Name	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)	US Node Name	DS Node Name
E.Drain2	10.000	9.5	1000	Circular	10.000	8.350	0.650	9.500	7.300	1.200	E.Impermeable	E.Outlet
E.Outfall	10.000	20.0	1000	Ditch	9.500	7.300	1.200	9.000	6.800	1.200	E.Outlet	E.Discharge
P.Drain2	10.000	20.0	1000	Circular	10.000	7.800	1.200	9.500	7.300	1.200	P.Impermeable	P.Outlet
P.Outfall	10.000	20.0	1000	Ditch	9.500	7.300	1.200	9.000	6.800	1.200	P.Outlet	P.Discharge

Indicative Drainage Calculations

Simulation Results

Appendix A.3

Scheme Title	2130 Trinity Vicarage Road
Analysis Title	Existing Site Drainage
Date	20/07/2018
Name	Sebastian Bures
Software	Causeway Flow+ V7.0



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Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	E.Impermeab	10	8.377	0.027	11.9	0.0573	0.0000	OK	E.Drain2	E.Outlet	11.9	3.406	0.001	0.0371	
15 minute summer	E.Outlet	10	7.314	0.014	11.9	0.0000	0.0000	OK	E.Outfall	E.Discharge	11.9	1.675	0.001	0.0710	4.6
15 minute summer	E.Discharge	10	6.814	0.014	11.9	0.0000	0.0000	OK							
15 minute summer	P.Impermeab	10	7.834	0.034	13.9	0.1181	0.0000	OK	P.Drain2	P.Outlet	13.9	2.910	0.002	0.0513	
15 minute summer	P.Outlet	10	7.315	0.015	13.9	0.0000	0.0000	OK	P.Outfall	P.Discharge	13.9	1.778	0.001	0.0782	5.4
15 minute summer	P.Discharge	10	6.815	0.015	13.9	0.0000	0.0000	OK							

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	E.Impermeab	10	8.389	0.039	29.3	0.0847	0.0000	OK	E.Drain2	E.Outlet	29.3	4.128	0.003	0.0722	
15 minute summer	E.Outlet	10	7.324	0.024	29.3	0.0000	0.0000	OK	E.Outfall	E.Discharge	29.3	2.361	0.002	0.1241	11.4
15 minute summer	E.Discharge	10	6.824	0.024	29.3	0.0000	0.0000	OK							
15 minute summer	P.Impermeab	10	7.851	0.051	34.1	0.1760	0.0000	OK	P.Drain2	P.Outlet	34.1	3.553	0.005	0.1004	
15 minute summer	P.Outlet	10	7.327	0.027	34.1	0.0000	0.0000	OK	P.Outfall	P.Discharge	34.1	2.499	0.003	0.1365	13.3
15 minute summer	P.Discharge	10	6.827	0.027	34.1	0.0000	0.0000	OK							

Results for 100 year Critical Storm Duration. Lowest mass balance: 100.00%

Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
-------	------------	-------------	-----------	-----------	--------------	---------------	------------	--------	---------	------------	---------------	----------------	----------	---------------	--------------------

Indicative Drainage Calculations

Simulation Results

Appendix A.3

15 minute summer	E.Impermeab	10	8.394	0.044	38.0	0.0952	0.0000 OK	E.Drain2	E.Outlet	38.0	4.360	0.004	0.0887	
15 minute summer	E.Outlet	9	7.328	0.028	38.0	0.0000	0.0000 OK	E.Outfall	E.Discharge	38.0	2.603	0.003	0.1460	14.8
15 minute summer	E.Discharge	10	6.828	0.028	38.0	0.0000	0.0000 OK							
15 minute summer	P.Impermeab	9	7.857	0.057	44.2	0.1987	0.0000 OK	P.Drain2	P.Outlet	44.3	3.759	0.006	0.1229	
15 minute summer	P.Outlet	10	7.331	0.031	44.3	0.0000	0.0000 OK	P.Outfall	P.Discharge	44.3	2.755	0.004	0.1608	17.2
15 minute summer	P.Discharge	10	6.831	0.031	44.3	0.0000	0.0000 OK							

Results for 100 year +20% Critical Storm Duration. Lowest mass balance: 100.00%

Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	E.Impermeab	10	8.398	0.048	45.5	0.1033	0.0000	OK	E.Drain2	E.Outlet	45.6	4.541	0.004	0.1029	
15 minute summer	E.Outlet	9	7.332	0.032	45.6	0.0000	0.0000	OK	E.Outfall	E.Discharge	45.6	2.785	0.004	0.1638	17.7
15 minute summer	E.Discharge	10	6.832	0.032	45.6	0.0000	0.0000	OK							
15 minute summer	P.Impermeab	9	7.862	0.062	53.1	0.2163	0.0000	OK	P.Drain2	P.Outlet	53.2	3.864	0.007	0.1410	
15 minute summer	P.Outlet	10	7.335	0.035	53.2	0.0000	0.0000	OK	P.Outfall	P.Discharge	53.2	2.947	0.005	0.1806	20.7
15 minute summer	P.Discharge	10	6.835	0.035	53.2	0.0000	0.0000	OK							

Results for 100 year 360 minute winter. 600 minute analysis at 8 minute timestep. Mass balance: 100.00%

Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute winter	E.Impermeab	184	8.367	0.017	4.4	0.0365	0.0000	OK	E.Drain2	E.Outlet	4.4	2.539	0.000	0.0182	
360 minute winter	E.Outlet	184	7.308	0.008	4.4	0.0000	0.0000	OK	E.Outfall	E.Discharge	4.4	1.138	0.000	0.0387	37.5
360 minute winter	E.Discharge	184	6.808	0.008	4.4	0.0000	0.0000	OK							
360 minute winter	P.Impermeab	184	7.822	0.022	5.1	0.0763	0.0000	OK	P.Drain2	P.Outlet	5.1	2.203	0.001	0.0250	
360 minute winter	P.Outlet	184	7.308	0.008	5.1	0.0000	0.0000	OK	P.Outfall	P.Discharge	5.1	1.205	0.000	0.0423	43.5
360 minute winter	P.Discharge	184	6.808	0.008	5.1	0.0000	0.0000	OK							

Scheme Title	2130 Trinity Vicarage Road
Analysis Title	Proposed Drainage System
Date	20/07/2018
Name	Sebastian Bures
Software	Causeway Flow+ V7.0



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Rainfall Methodology	FEH-99
C (1km)	-0.028
D1 (1km)	0.372
D2 (1km)	0.337
D3 (1km)	0.270
E (1km)	0.307
F (1km)	2.343
Summer CV	1.000
Winter CV	1.000
Analysis Speed	Normal
Drain Down Time (mins)	240
Additional Storage (m³/ha)	20.0

Storm Durations (mins)
15
30
60
120
180
240
360
480
600
720
960
1440
2160
2880
4320

Return Period (years)	Climate Change (%)
2	0
2	20
30	0
30	20
100	0
100	20
100	40

Scheme Title	2130 Trinity Vicarage Road
Analysis Title	Proposed Drainage System
Date	20/07/2018
Name	Sebastian Bures
Software	Causeway Flow+ V7.0



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NODES

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Node Type	Manhole Type	Diameter (mm)	Width (mm)	Easting (m)	Northing (m)	Depth (m)
MH1	0.036	4.00		116.100	Manhole	Adoptable	1200		442420.000	293863.000	0.525
MH2	0.036	4.00		116.100	Manhole	Adoptable	1200		442420.000	293870.000	0.600
MH3				116.100	Manhole	Adoptable	1200		442425.000	293870.000	0.621

LINKS

Name	US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)
1.001	MH1	MH2	7.000	0.600	Colebrook-V	115.575	115.500	0.075	93.3	225	Circular	4.09	200.0
1.002	MH2	MH3	5.000	0.600	Colebrook-V	115.500	115.479	0.021	238.1	300	Circular	4.17	200.0

Scheme Title 2130 Trinity Vicarage Road
Analysis Title Proposed Drainage System
Date 20/07/2018
Name Sebastian Bures
Software Causeway Flow+ V7.0

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Hydro-Brake®

Node	Flap Valve	Online / Offline	Downstream Link	Replaces Downstream Link	Loop to Node	Invert Level (m)	Design Depth (m)	Design Flow (l/s)	Objective	Product Number	Min Outlet Diameter (m)	Min Node Diameter (mm)
MH3	x	Online		✓		115.479	0.600	2.0	Minimise upstream s	HE-0073-2000-060	0.100	1200

Carpark

Node	Base Inf Coefficient (m/hr)	Side Inf Coefficient (m/hr)	Safety Factor	Porosity	Invert Level (m)	Time to half empty (mins)	Width (m)	Length (m)	Slope (1:X)	Depth (m)	Inf Depth (m)
MH2	0.00100	0.00000	2.0	0.30	115.650		31.000	10.000	100.0		

Scheme Title	2130 Trinity Vicarage Road
Analysis Title	Proposed Drainage System
Date	20/07/2018
Name	Sebastian Bures
Software	Causeway Flow+ V7.0



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Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	MH1	25	115.720	0.145	5.6	0.3618	0.0000	OK	1.001	MH2	3.2	0.317	0.060	0.2323	
30 minute summer	MH2	24	115.718	0.218	8.5	2.6779	0.0000	OK	1.002	MH3	2.8	0.377	0.038	0.2878	
									Infiltration		0.0				
30 minute summer	MH3	24	115.718	0.239	2.8	0.2705	0.0000	OK	Hydro-Brake®		2.0				6.5

Results for 2 year +20% Critical Storm Duration. Lowest mass balance: 100.00%

Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute summer	MH1	43	115.733	0.158	4.9	0.3956	0.0000	OK	1.001	MH2	4.5	0.291	0.084	0.2436	
60 minute summer	MH2	43	115.733	0.233	9.0	3.7415	0.0000	OK	1.002	MH3	2.5	0.355	0.035	0.3056	
									Infiltration		0.0				
60 minute summer	MH3	43	115.733	0.254	2.5	0.2871	0.0000	OK	Hydro-Brake®		2.0				9.9

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	MH1	59	115.832	0.257	7.3	0.6439	0.0000	FLOOD RISK	1.001	MH2	6.9	0.346	0.129	0.2784	
60 minute winter	MH2	59	115.832	0.332	14.2	13.0869	0.0000	FLOOD RISK	1.002	MH3	2.5	0.372	0.035	0.3521	
									Infiltration		0.0				
60 minute winter	MH3	59	115.832	0.353	2.5	0.3996	0.0000	OK	Hydro-Brake®		2.0				20.8

Indicative Drainage Calculations

Simulation Results

Appendix A.3

Results for 30 year +20% Critical Storm Duration. Lowest mass balance: 100.00%

Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	MH1	60	115.875	0.300	8.8	0.7509	0.0000	FLOOD RISK	1.001	MH2	8.4	0.356	0.155	0.2784	
60 minute winter	MH2	60	115.875	0.375	17.2	17.1703	0.0000	FLOOD RISK	1.002	MH3	2.9	0.379	0.041	0.3521	
									Infiltration		0.0				
60 minute winter	MH3	60	115.875	0.396	2.9	0.4480	0.0000	OK	Hydro-Brake®		2.0				24.9

Results for 100 year Critical Storm Duration. Lowest mass balance: 100.00%

Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	MH1	60	115.929	0.354	10.6	0.8861	0.0000	FLOOD RISK	1.001	MH2	10.1	0.375	0.188	0.2784	
60 minute winter	MH2	60	115.929	0.429	20.7	22.3284	0.0000	FLOOD RISK	1.002	MH3	3.1	0.393	0.044	0.3521	
									Infiltration		0.0				
60 minute winter	MH3	60	115.929	0.450	3.1	0.5092	0.0000	OK	Hydro-Brake®		2.0				30.2

Results for 100 year +20% Critical Storm Duration. Lowest mass balance: 100.00%

Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	MH1	116	115.994	0.419	7.6	1.0481	0.0000	FLOOD RISK	1.001	MH2	7.3	0.325	0.135	0.2784	
120 minute winter	MH2	116	115.994	0.494	14.9	28.4884	0.0000	FLOOD RISK	1.002	MH3	2.3	0.350	0.032	0.3521	
									Infiltration		0.0				
120 minute winter	MH3	116	115.994	0.515	2.3	0.5823	0.0000	OK	Hydro-Brake®		2.0				39.0

Results for 100 year +40% Critical Storm Duration. Lowest mass balance: 100.00%

Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	MH1	118	116.065	0.490	8.9	1.2255	0.0000	FLOOD RISK	1.001	MH2	8.5	0.339	0.158	0.2784	
120 minute winter	MH2	118	116.065	0.565	17.4	35.2491	0.0000	FLOOD RISK	1.002	MH3	2.3	0.377	0.032	0.3521	
									Infiltration		0.0				
120 minute winter	MH3	118	116.065	0.586	2.3	0.6625	0.0000	OK	Hydro-Brake®		2.0				39.3

Indicative Drainage Calculations

Simulation Results

Appendix A.3

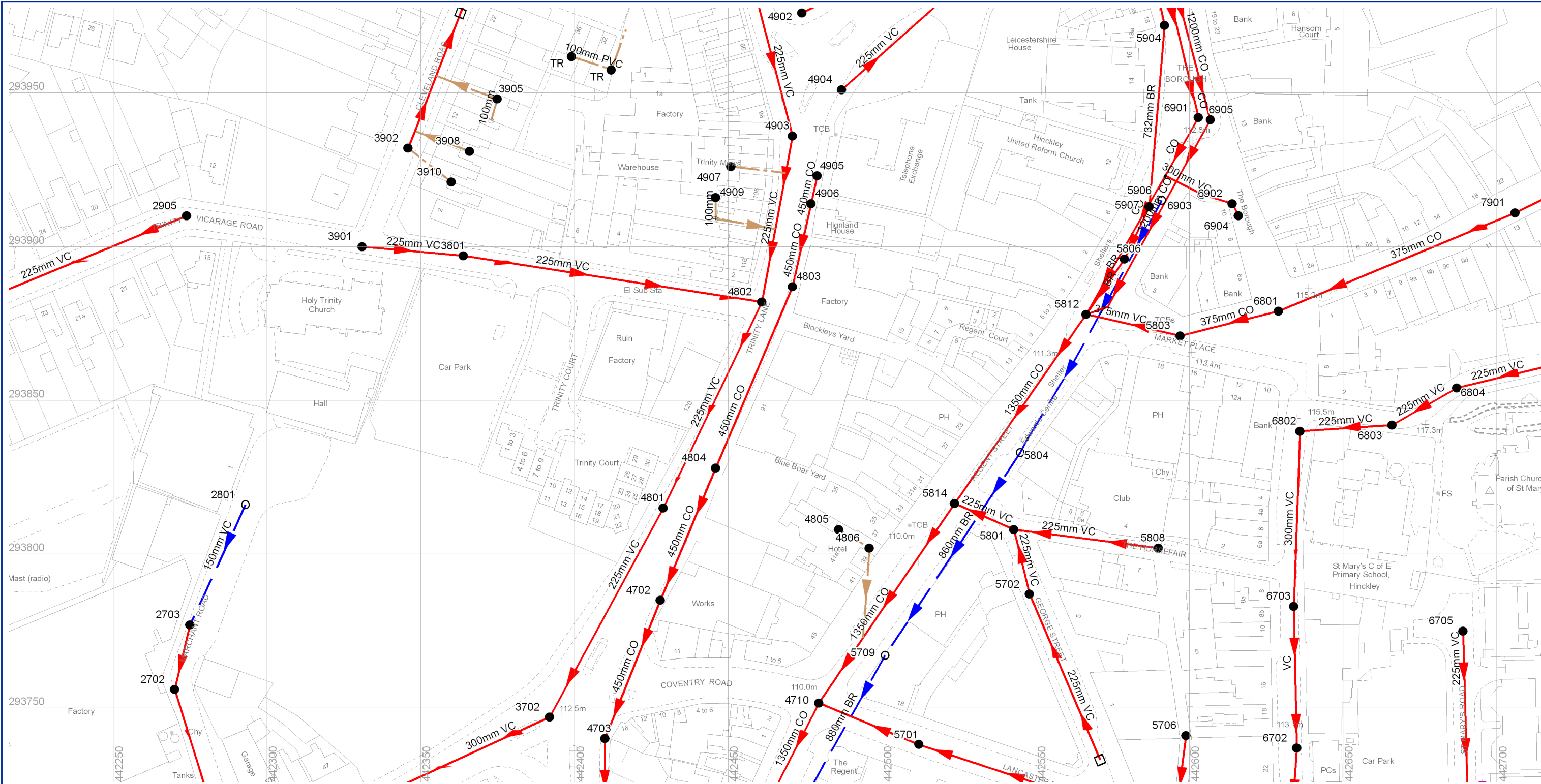
Results for 100 year +20% 360 minute winter. 600 minute analysis at 8 minute timestep. Mass balance: 100.00%

Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute winter	MH1	272	115.940	0.365	3.3	0.9136	0.0000	FLOOD RISK	1.001	MH2	3.2	0.249	0.059	0.2784	
360 minute winter	MH2	272	115.940	0.440	6.5	23.3615	0.0000	FLOOD RISK	1.002	MH3	2.2	0.183	0.030	0.3521	
									Infiltration		0.0				
360 minute winter	MH3	272	115.940	0.461	2.2	0.5215	0.0000	OK	Hydro-Brake®		2.0				55.8

Results for 100 year +40% 360 minute winter. 600 minute analysis at 8 minute timestep. Mass balance: 100.00%

Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute winter	MH1	272	116.014	0.439	3.9	1.0978	0.0000	FLOOD RISK	1.001	MH2	3.7	0.265	0.070	0.2784	
360 minute winter	MH2	272	116.014	0.514	7.6	30.3810	0.0000	FLOOD RISK	1.002	MH3	2.1	0.193	0.030	0.3521	
									Infiltration		0.0				
360 minute winter	MH3	272	116.014	0.535	2.1	0.6048	0.0000	OK	Hydro-Brake®		2.0				62.9

Appendix A.4 – Seven Trent Asset Location



- Abandoned Gravity 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)

- Culverted Watercourse
- Cable, Earthing
- Cable Junction
- Cable, Optical Fibre/Instrumentation
- Cable, Low Voltage
- Cable, High Voltage
- Cable, Other
- Housing, Building
- Housing, Kiosk
- Disposal Site
- 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
- Pre-1937 Properties

MATERIALS

- NONE
- 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
- GRP - GLASS REINFORCED PLASTIC
- 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
- ST - STEEL
- U - UNKNOWN
- VC - VITRIFIED CLAY
- XXX - OTHER

SHAPE

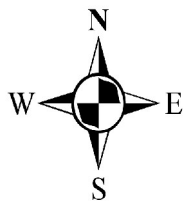
- C - CIRCULAR
- E - EGG SHAPED
- O - OTHER
- R - RECTANGLE
- S - SQUARE
- T - TRAPEZOIDAL
- U - UNKNOWN

PURPOSE

- C - COMBINED
- E - FINAL EFFLUENT
- F - FOUL
- L - SLUDGE
- S - SURFACE WATER

CATEGORIES

- W - WEIR
- C - CASCADE
- DB - DAMBOARD
- SE - SIDE ENTRY
- FV - FLAP VALVE
- BD - BACK DROP
- S - SIPHON
- HD - HIGHWAY DRAIN
- S104 - SECTION 104



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SEWER RECORD

O/S Map scale: 1:1250
Date of issue: 24.07.18

This map is centred upon:
O / S Grid reference:
x : 442465
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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 1st October 2011, but have not been surveyed and confirmed by Severn Trent Water are shown in orange

Sewer Node		Sewer Pipe Data								
REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SP42933606	109.44	107.76	107.15	C	CO	C	525	nil	26.85	nil
SP42933623	nil	nil	nil	F	nil	nil	nil	nil	0.00	nil
SP42933624	nil	nil	nil	F	nil	nil	nil	nil	0.00	nil
SP42933631	nil	nil	nil	F	nil	nil	nil	nil	0.00	nil
SP42933701	111.94	108.77	107.55	C	VC	C	300	nil	56.91	nil
SP42933701	111.94	109.22	nil	C	VC	C	300	nil	0.00	nil
SP42933702	112.44	109.94	109.04	C	VC	C	300	nil	92.97	nil
SP42933703	111.71	110.18	108.00	S	VC	C	150	nil	23.98	nil
SP42933801	119.28	118.17	114.31	C	VC	C	225	nil	25.43	nil
SP42933901	119.23	118.48	118.19	C	VC	C	225	nil	114.28	nil
SP42933902	120.01	118.48	118.15	C	VC	C	225	nil	142.94	nil
SP42933905	nil	nil	nil	F	nil	nil	nil	nil	0.00	nil
SP42933908	nil	nil	nil	F	nil	nil	nil	nil	0.00	nil
SP42933910	nil	nil	118.49	F	nil	nil	nil	nil	0.00	nil
SP42934604	109.18	107.41	nil	S	BR	S	880	nil	0.14	nil
SP42934608	110.12	108.45	107.76	C	CO	C	525	nil	32.12	nil
SP42934702	113.37	111.57	109.20	C	CO	C	450	nil	20.45	nil
SP42934703	111.60	109.06	108.71	C	CO	C	525	nil	60.00	nil
SP42934704	110.77	108.70	108.48	C	CO	C	525	nil	139.05	nil
SP42934710	109.90	106.16	105.29	C	CO	nil	nil	nil	106.77	nil
SP42934801	114.79	112.11	110.10	C	VC	C	225	nil	38.51	nil
SP42934802	116.68	114.00	112.15	C	VC	C	225	nil	40.14	nil
SP42934803	116.83	115.17	113.75	C	CO	C	450	nil	45.13	nil
SP42934804	115.60	113.72	111.65	C	CO	C	450	nil	22.52	nil
SP42934805	nil	nil	nil	F	nil	nil	nil	nil	0.00	nil
SP42934806	nil	nil	nil	F	nil	nil	nil	nil	0.00	nil
SP42934901	119.09	116.65	115.30	C	VC	C	225	nil	46.71	nil
SP42934902	118.01	115.89	112.11	C	VC	C	225	nil	21.77	nil
SP42934903	117.96	115.29	114.23	C	VC	C	225	nil	51.81	nil
SP42934904	117.82	116.26	112.94	C	VC	C	225	nil	29.44	nil
SP42934905	117.90	116.36	116.20	C	CO	C	450	nil	57.63	nil
SP42934906	117.60	115.90	115.18	C	CO	C	450	nil	38.42	nil
SP42934907	nil	nil	nil	F	nil	nil	nil	nil	0.00	nil
SP42934909	nil	nil	nil	F	nil	nil	nil	nil	0.00	nil
SP42935603	110.22	108.78	108.09	S	VC	C	225	nil	43.48	nil
SP42935604	110.15	109.02	108.65	F	VC	C	150	nil	106.92	nil
SP42935606	110.69	109.28	108.82	S	VC	C	225	nil	62.59	nil
SP42935609	111.09	109.71	109.65	F	VC	C	150	nil	0.00	nil
SP42935610	110.69	109.54	109.46	F	VC	C	150	nil	0.00	nil
SP42935615	110.97	108.10	nil	S	CO	C	525	nil	0.00	nil
SP42935616	111.25	108.05	108.02	S	CO	C	525	nil	0.00	nil
SP42935617	110.81	108.02	107.97	S	CO	C	525	nil	0.00	nil
SP42935618	nil	107.97	107.93	S	CO	C	525	nil	0.00	nil
SP42935700	111.11	109.65	109.54	F	VC	C	150	nil	0.00	nil
SP42935701	110.14	nil	nil	C	nil	nil	nil	nil	0.00	nil
SP42935702	111.10	108.45	nil	C	VC	C	225	nil	0.00	nil

MATERIALS		SHAPE		PURPOSE	
-	- NONE	PE	- POLYETHYLENE	C	- CIRCULAR
AC	- ASBESTOS CEMENT	PF	- PITCH	E	- EGG SHAPED
BR	- BRICK	PP	- POLYPROPYLENE	O	- OTHER
CC	- CONCRETE BOX CULVERT	PSC	- PLASTIC STEEL COMPOSITE	R	- RECTANGLE
CI	- CAST IRON	PVC	- POLYVINYL CHLORIDE	S	- SQUARE
CO	- CONCRETE	RPM	- REINFORCED PLASTIC MATRIX	T	- TRAPEZOIDAL
CSB	- CONCRETE SEGMENTS (BOLTED)	SI	- SPUN (GREY) IRON	U	- UNKNOWN
CSU	- CONCRETE SEGMENTS (UNBOLTED)	ST	- STEEL		
DI	- DUCTILE IRON	U	- UNKNOWN		
GRC	- GLASS REINFORCED CONCRETE	VC	- VITRIFIED CLAY		
RP	- GLASS REINFORCED PLASTIC	XXX	- OTHER		
MAC	- MASONRY IN REGULAR COURSES				
MAR	- MASONRY RANDOMLY COURSED				



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SEWER RECORD DATA TABLE

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Sewer Node		Sewer Pipe Data								
REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SP42935704	110.68	109.46	109.29	F	VC	C	150	nil	0.00	nil
SP42935705	111.58	108.78	nil	C	VC	C	375	nil	0.00	nil
SP42935705	111.58	108.78	nil	C	VC	C	375	nil	0.00	nil
SP42935706	112.82	110.34	108.81	C	VC	C	225	nil	19.78	nil
SP42935708	110.84	108.63	nil	F	VC	C	150	nil	0.00	nil
SP42935709	109.79	108.27	107.41	S	BR	S	880	nil	128.08	nil
SP42935801	110.86	nil	nil	C	VC	C	225	nil	0.00	nil
SP42935803	113.03	110.46	108.79	C	VC	C	375	nil	18.74	nil
SP42935804	110.62	109.23	108.27	S	BR	S	860	nil	78.65	nil
SP42935806	111.76	109.89	nil	C	BR	E	670	710	0.00	nil
SP42935808	113.60	111.83	nil	C	VC	C	225	nil	0.00	nil
SP42935812	111.62	107.55	106.94	C	CO	nil	nil	nil	122.84	nil
SP42935814	110.90	106.94	106.61	C	CO	C	1350	nil	237.94	nil
SP42935902	112.48	110.72	110.63	C	CO	C	450	nil	102.44	nil
SP42935903	112.51	109.95	109.14	C	CO	E	900	600	58.40	nil
SP42935903	112.51	109.05	108.57	C	CO	C	1200	nil	103.21	nil
SP42935904	112.46	110.54	110.02	C	BR	S	732	nil	113.87	nil
SP42935905	112.57	110.73	110.73	C	CO	C	450	nil	0.00	nil
SP42935906	112.13	110.09	nil	S	BR	E	410	610	0.00	nil
SP42935907	111.99	110.01	109.93	C	BR	S	732	nil	234.88	nil
SP42935910	112.60	110.20	109.70	C	CO	C	900	nil	12.02	nil
SP42936801	114.88	113.08	111.39	C	CO	C	375	nil	19.51	nil
SP42936901	112.85	109.10	nil	C	CO	E	900	600	0.00	nil
SP42936902	112.97	111.34	110.71	C	VC	C	300	nil	16.57	nil
SP42936903	112.54	110.54	nil	C	VC	C	300	nil	0.00	nil
SP42936904	113.07	111.42	111.37	C	VC	C	300	nil	89.40	nil
SP42936905	112.83	108.57	107.70	C	CO	C	1200	nil	88.14	nil
SP42943003	121.67	117.78	116.80	C	VC	C	225	nil	79.07	nil
SP42944001	120.57	118.26	116.73	C	VC	C	225	nil	34.24	nil
SP42945001	114.35	112.10	110.53	C	VC	C	225	nil	16.38	nil
SP42945002	114.23	112.89	111.42	C	VC	C	225	nil	11.59	nil
SP42945004	114.14	111.85	111.31	C	CO	C	375	nil	24.70	nil
SP42945005	113.32	110.07	109.60	C	CO	C	525	nil	55.68	nil
SP42945006	113.04	111.28	110.75	C	CO	C	450	nil	59.09	nil
SP42946011	113.20	110.62	110.54	C	CO	C	675	nil	152.63	nil
SP42946012	112.90	nil	nil	C	CO	C	750	nil	0.00	nil
SP42946013	112.94	110.54	110.49	C	CO	C	750	nil	89.40	nil
nil	nil	nil	nil	F	PVC	nil	nil	nil	0.00	nil

MATERIALS

- NONE	PE - POLYETHYLENE
AC - ASBESTOS CEMENT	PF - PITCH
BR - BRICK	PP - POLYPROPYLENE
CC - CONCRETE BOX CULVERT	PSC - PLASTIC STEEL COMPOSITE
CI - CAST IRON	PVC - POLYVINYL CHLORIDE
CO - CONCRETE	RPM - REINFORCED PLASTIC MATRIX
CSB - CONCRETE SEGMENTS (BOLTED)	SI - SPUN (GREY) IRON
CSU - CONCRETE SEGMENTS (UNBOLTED)	ST - STEEL
DI - DUCTILE IRON	U - UNKNOWN
GRC - GLASS REINFORCED CONCRETE	VC - VITRIFIED CLAY
RP - GLASS REINFORCED PLASTIC	XXX - OTHER
MAC - MASONRY IN REGULAR COURSES	
MAR - MASONRY RANDOMLY COURSED	

SHAPE

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...



Severn Trent Water Limited
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PO Box 5344
Coventry
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SEWER RECORD DATA TABLE

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Severn Trent Water does not possess complete records of these assets.
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