Diamond Wood & Shaw Limited

# Flood Risk Assessment

**Residential development on site of former Little India Restaurant**

**7 Main Street**
**Peckleton**
**Leicester**
**LE9 7RE**

**Document Reference: 23-20082 0-040P3**

*The Old School, Blaby Road, Enderby, Leicester LE19 4AR*
T: *+44 (0)116 284 8989* E: *mail@dwsltd.co.uk* W: *www.diamondwoodandshaw.co.uk*

# Flood Risk Assessment

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|---|---|
| Client: | **S and S Contracting Ltd**<br>**Unit 5 Warren Park Way**<br>**Enderby**<br>**Leicester**<br>**Leicestershire**<br>**LE19 4SA** |
| Contractor: | **Same as above** |
| Planning: | **Mair Land & Planning Consultants Ltd** |
| Project: | **Residential Development on site of former Little India Restaurant, 7 Main Street, Peckleton, LE9 7RE** |
| Project No: | **23-20082** |
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| Engineer: | **Leigh Middleton** |

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***Diamond Wood and Shaw Limited***

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## 1.0 Background

1.1 Diamond Wood & Shaw Limited are structural and drainage consulting engineers who have been appointed to complete a Flood Risk Assessment for the proposed development at the former site of the Little India Restaurant, Peckleton LE9 7RE. Easting and northing for the approximate centre of the site are 446794mE 301035mN.

This Flood Risk Assessment has been prepared by a drainage engineer with ICE Graduate membership and over ten years experience in drainage design. The Assessment is compliant with the requirements set out in the NPPF (February 2021) and has been produced on behalf of S & S Contracting Ltd. with respect to the above site.

## 2.0 Existing Site

2.1 The site is situated in the town of Peckleton, Leicestershire. The site is bounded by undeveloped/green fields to the north, west and south. There is to the immediate west a house before the undeveloped fields. There are residential properties and a farm to the east with an unnamed water course between them and the site.

2.2 The site is roughly square in shape and the redline (green) boundary is approximately 1,937m$^2$.

2.3 The current site is largely pre-developed with buildings and areas of hardstanding. The buildings are brickwork construction with asphalt hardstanding areas. It is accessed off Kirkby Lane/Main Street at two locations to either side of the main restaurant building, the accesses pass over a public footway. The site is currently a restaurant called Little India.

2.4 A site topographical survey has been completed. The road level at the western entrance is 101.55m AOD and 101.68m AOD at the eastern entrance. The entrances flank either side of the existing building which has an FFL 102.25m AOD. The entrance ways also lead to asphalted areas which rise to a level of 103.54m AOD in the west and 102.47m AOD in the east. These asphalted areas are linked around the back of the building with a gravel track that has a level in the north of 103.44m AOD. Beyond the track is vegetation. Generally, there is fall across the site from north to south (towards the road) and from west to east (towards the watercourse on the eastern boundary).

2.5 At the time of writing this report a full ground investigation has not been completed. Using the British Geological Survey's (BGS) Geology Map of Britain we can determine that the bedrock is likely to be Gunthorpe mudstone.

BGS describes Gunthorpe Member as:

> *"Mudstone, red-brown, with subordinate dolomitic siltstone and fine-grained sandstone, greenish grey, common gypsum veins and nodules."*

The Mapping unfortunately doesn't show the superficial deposits, but considering the local surface soil types and the adjacent watercourse it is likely to be a soil that cannot support infiltration drainage techniques.

DEFRA's magic map shows that the bedrock is a secondary B aquifer, and the superficial deposits are unproductive. The magic map also indicates that the site is in an area with high groundwater vulnerability.

Please see appendix C and D for extracts of the BGS mapping and DEFRA magic map respectively.

2.6 There are two local surface water features in close proximity to the site, they are:

- An unnamed watercourse that forms the east boundary of the site.
- The combined sewer that runs in Main Street and Kirby Lane from both directions to the junction opposite the site and then continues along Manor Lane.

Please see appendix F for details of the location and manholes for the sewers.

## 3.0 Flood Risk

3.1 The Government, within the NPPF, has determined that developments in the national planning context should seek:

*"Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere."*

This is then achieved by using sequential risk-based approach to the location of the development that takes into account climate change to avoid flood risk to people and property. This is done by applying the sequential test, the aim of the sequential test is to...

*"...steer new development to areas with the lowest risk of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying this test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding."*

There are times where development cannot be directed to areas of lower flood risk. In these cases, the exception test will have applied which is based on the vulnerability classification of the development. There are two aspects of the exception test, and both have to be passed for the development to pass the exception test. The NPPF advises that:

*"For the exception test to be passed it should be demonstrated that:*

*a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and*
*b) the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall."*

3.2 A Flood Risk Assessment (FRA) is only required when a site falls into one of three situations, they are:

1) The site is in flood zone 1 and is over 1ha.
2) The site is in flood zone 2.
3) The site is in flood zone 3.

3.3 To assess the flood risk for a site you must first identify the flood risk zone classification. The classes are:

| Flood Zone | Definition |
|---|---|
| Zone 1 Low Probability | Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3) |
| Zone 2 Medium Probability | Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. |
| Zone 3a High Probability | Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding |
| Zone 3b The Functional Floodplain | This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. Land where water flows or is stored in times of flood. |

The zone can be identified by many different sources, most commonly using the EA's Flood Map For Planning or the local SFRA. The flood zones are determined using modelling of the local areas topographical, flood risk and other features to determine impact of a series of flooding events, which then is translated into one of the above zones.

3.4 All developments will fall into one of five vulnerability classification. An assessment of the development needs to be made and a classification identified for the site. The classifications are:

**Essential infrastructure**

- Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk.
- Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.
- Wind turbines.

**Highly vulnerable**

- Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding.
- Emergency dispersal points.
- Basement dwellings.
- Caravans, mobile homes and park homes intended for permanent residential use.
- Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure').

**More vulnerable**

- Hospitals
- Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
- Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.
- Non–residential uses for health services, nurseries and educational establishments.
- Landfill and sites used for waste management facilities for hazardous waste.
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

**Less vulnerable**

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

- Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.

**Water-compatible development**

- Flood control infrastructure.
- Water transmission infrastructure and pumping stations.
- Sewage transmission infrastructure and pumping stations.
- Sand and gravel working.
- Docks, marinas and wharves.
- Navigation facilities.
- Ministry of Defence defence installations.
- Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.
- Water-based recreation (excluding sleeping accommodation).
- Lifeguard and coastguard stations.
- Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

3.5 Once the flood zone and vulnerability has been determined a check on the sites flood risk compatibility will need to be made. This assessment is made by using a table located with the NPPG. The table is:

| **Flood Zone** | **Vulnerability classification** | | | | |
|---|---|---|---|---|---|
| | Essential infrastructure | Highly vulnerable | More vulnerable | Less vulnerable | Water-compatible |
| Zone 1 | ✓ | ✓ | ✓ | ✓ | ✓ |
| Zone 2 | ✓ | Exception test required | ✓ | ✓ | ✓ |
| Zone 3a | Exception test required | × | Exception test required | ✓ | ✓ |
| Zone 3b | Exception test required | × | × | × | ✓ |

✓ development permitted × development not permitted.

Using the table, the suitability of the location of the development can be made, this coupled with the application of a climate change percentage will determine whether the development will pass the sequential test.

3.6 As our environment that we live in changes due to our presence, it is likely that the peak river flow and/or rainfall will also increase as a result. To account for this, a percentage factor needs to be added to our assessments and design calculations.

For larger developments and rural areas, consideration of the increase in peak river flow is required. The increase applied is dependent on the particular river basin within which the site is located. Climate change will also have an effect on rainfall by increasing the peak intensity of the rainfall or river flow. Details of the river basins and the climate change percentage to be applied can be found within the Government guidance. There are three levels of increase that can be applied which are determined using the sites flood zone and vulnerably classification. These levels are known as central, higher central and upper end allowances, these are specifically referred to by the peak river flow numbers. The percentage level is applied in line with the following table:

| **Flood Zone** | **Vulnerability classification** | | | | |
|---|---|---|---|---|---|
| | Essential infrastructure | Highly vulnerable | More vulnerable | Less vulnerable | Water-compatible |
| Zone 2 | Upper end | Higher central and upper end | Higher central and upper end | Central and higher central | Central |
| Zone 3a | Upper end | × | Higher central and upper end | Central and higher central | Central |
| Zone 3b | Upper end | × | × | × | Central |

× Development not permitted.

Consideration to sites just outside of flood zone 2 and 3a also may need to be made, as the increase in flood risk due to climate change, changes in level, etc. may put them in a higher zone in the future.

Usually, the EA will hold modelled data for flood levels, along with expected flood levels associated with breaches of any flood defences or banks that the EA maintain; this comes in the form of modelled flood maps.

Any development which is to be located within a flood plain may also need to provide storage compensation for the potential loss. This is important as the loss of flood plain storage could result in the development site becoming flooded or may displace flood volumes to another area and increase their risk. The use of upper end, higher central or central values for this calculation will depend on the sensitivity of the floodplain to small changes in volume and the vulnerability classification of the development.

In this case, the site falls into the Soar Management Catchment, for which the predicted increase in flows are as follows:

| **Soar management Catchment Peak River Flow Allowances** | **Total potential change anticipated for the '2020s' (2015 to 2039)** | **Total potential change anticipated for the '2050s' (2040 to 2069)** | **Total potential change anticipated for the '2080s' (2070 to 2115)** |
|---|---|---|---|
| Upper | 28% | 35% | 60% |
| Higher | 18% | 21% | 37% |
| Central | 14% | 16% | 28% |

However, the guidance states that for small (less than 5km²) and urbanised sites, peak rainfall allowances should be used for climate change increases instead. For the peak rainfall only upper and central are used. These are as follows:

| **Soar management Catchment Peak Rainfall Allowances** | **Total potential change for 3.3% AEP anticipated for the '2050s' (up to 2060)** | **Total potential change for 3.3% AEP anticipated for the '2070s' (2061 to 2125)** | **Total potential change for 1% AEP anticipated for the '2050s' (up to 2060)** | **Total potential change for 1% AEP anticipated for the '2070s' (2061 to 2125)** |
|---|---|---|---|---|
| Upper | 35% | 35% | 40% | 40% |
| Central | 20% | 25% | 20% | 25% |

For the smaller catchments, developments with a lifetime beyond 2100 should use the upper figures ones between 2061 and 2100 should use the central allowance for the 2070s epoch and for any development up to 2060 use the central allowance for the 2050s epoch. These

are based on the expected lifetime and not the design life, the guidance states that residential developments are to have a minimum lifetime of 100 years.

These figures are utilised within the proposed drainage design to ensure that any development within a flood risk area proposed does not cause any run-off from the development for the required realization of the risk, and the design life of the development dictates which percentage figure should be applied. Where there is any on site flooding indicated within the flood mapping provided, adjustments to the finished floor levels should be made to ensure people and properties are protected.

## 4.0 Flood Risk For The Proposed Development Site

4.1 The proposed redevelopment of the site is for 4 residential dwellings and associated highway works. The planning boundary is approximately 0.193ha.

4.2 Using both the EA's Flood Map for Planning and the Hinckley and Bosworth Borough Council level 1 SFRA (2019), the site is classified to be in Flood Zone 1 for flooding from rivers and seas. This means the development site has less than 1 in 1000 (0.1% AEP) probability of flooding from rivers and sea.

Normally an FRA will not be required for sites in this zone and the site is under 1ha.

However, the site is at low risk from pluvial flooding. The source of the risk is the previously identified watercourse on the eastern boundary. This only partially affects the site.

The NPPF identifies that sites will need an FRA if they are:

> *"less than 1 ha in flood zone 1, including a change of use in development type to a more vulnerable (for example commercial to residential), where they could be affected by sources of flooding other than rivers and the sea (for example surface water drains, reservoirs)"*

As a result, this development will require an FRA.

Please see appendix B and appendix G for EA flood mapping and Hinckley & Bosworth Borough Council Level 1 SFRA extracts, respectively.

4.3 Using the vulnerability classifications in the NPPG a development of residential dwellings will be classified as 'more vulnerable'.

4.4 Applying the sequential test using the suitability table, i.e., the development is in flood zone 1 for rivers and seas and is 'more vulnerable'. The table indicates that the type of development is suitable for this site from the flooding from rivers and seas point of view.

4.5 The exception test does not need to be applied for this site.

4.6 Review of sources of flooding

| Flood Source | Presence | Risk | Description |
|---|---|---|---|
| Fluvial | None | N/A | The nearest main watercourse is the Rothley Brook that is 3.65km to the northeast of the site. The flood zones shows that the extents of the flood zone 2 and 3 do not extent to the site and even taking into account climate change for the increase in the peak river flow it will not affect the site. |
| Pluvial | Western boundary of the site | Low/ Medium | The eastern boundary of the site is a watercourse, it is identified in the Gov.uk long term flooding checker and the Hinckley and Bosworth Borough Council Level 1 SFRA as being at risk to pluvial flooding. This risk will be managed through directing the residential dwellings to areas of the site at lower risk.<br><br>Currently, the parking areas are not positively drained and likely run-off to the water course. The roof areas and the parking areas will be attenuated to greenfield rate (or as close as reasonably practical) to decrease the pressure the site places on the watercourse by reducing the potential flow to it.<br><br>Within the Hinckley and Bosworth Borough Council Level 1 SFRA (2019) there are no reports of any historical flooding for this site or surrounding areas. |
| Tidal | None | N/A | There is no coastline or tidal watercourses within vicinity of the development site. |
| Canals | None | N/A | There are no canals within vicinity of the development site. |
| Groundwater | On site | Very Low | The bedrock strata are designated by DEFRA (using their magic map, appendix D) as a secondary B aquifer, this means that the rock is |

| | | | |
|---|---|---|---|
| | | | of lower permeability and will only yield lower amounts of water. The superficial deposits are unproductive, this means that they are unable to provide usable water and are unlikely to have an ecosystem dependent on it.<br><br>Within the Hinckley and Bosworth Borough Council Level 1 SFRA (2019) there are no reports of any historical flooding for this site or surrounding areas.<br><br>Considering that both the strata are likely to have little capacity for base flow and only have minor value, the risk of groundwater flooding is considered to be very low. |
| Sewer | Site adjacent | Very Low | There is only one sewer that serves the site, it is a combined sewer, in Kirkby Lane & Manor Lane (please see appendix F). Within the Hinckley and Bosworth Borough Council Level 1 SFRA (2019) there are no reports of any historical flooding for this site or surrounding areas. It is likely that the current roof area of the building discharges to the sewer (a CCTV survey will be needed to confirm this), to follow the hierarchy a discharge to the watercourse should be made. Therefore, the amount water discharging to the sewer is reduced, also reducing the risk of flooding from this source. There is no reason to believe the sewer will be a potential source flooding. |
| Reservoirs | None | N/A | The Government's 'long term flood risk for an area' checker does not indicate that the site is at risk of flooding form reservoirs. |
| Development | On site | Very Low | The site's drainage will be developed to meet all appropriate standards and to store the 1 in 100 year event (1% AEP) plus 40% climate change, as a result of this it is considered to be a very low risk. |

4.7 DEFRA's magic map also highlights that the groundwater in the area has a high vulnerability classification. This means that consideration to the use of infiltration techniques (if viable and used) will need to be assessed to ensure that the groundwater does not become contaminated.

Please see appendix D and G for the DEFRA magic map extracts and the Hinckley & Bosworth District Council Level 1 SFRA extracts, respectively.

4.8 The site is located in the village of Peckleton which is a semi-urbanised area, it is also a small development (less than 5km²). The design life of the development will fall into the '2070s' category and as it is a residential development it will have a expected lifetime of 100 years so the upper allowance of the 2070s epoch should be applied. It is therefore appropriate to apply 40% climate change to the design which is in line with NPPG and the gov.uk guidance.

4.8 There is likely to be reduction in the foul water flood risk to the site and the surrounding area. It is believed that the current development discharges both foul and storm flows via the combined sewer at an unrestricted rate. As part of re-developing the site the drainage hierarchy will have to be followed, which places discharges to the combined/foul water sewer for surface water at the bottom and advises to avoid if at all possible. There is a watercourse along the western boundary, and discharges to a watercourse are above discharging to a combined sewer on the hierarchy. This option (to the watercourse) should therefore be explored as the primary method of surface water disposal. However, it is likely the discharge from the site to the watercourse will have to be limited to Greenfield run-off rate.

4.9 Overall the site is considered to be at low risk from the sources of flooding that can affect the site. These sources are pluvial, groundwater, sewer and the development itself. With careful management of the development to direct the development to the part of the site that is at the lowest risk and reducing the discharge rate to greenfield (or as low as reasonably practical) the risks can be managed. There is also likely to be reduction in the foul water flood risk as a result.

## 5.0 Drainage Strategy

5.1 As discussed previously, the re-development of the site is for 4 dwellings.

Regarding drainage there are two elements that need to be considered, they are the surface water from the roadway/parking & roof areas and the foul water from the properties.

5.2 Hierarchy

When designing a surface water drainage system for any site there is hierarchy of discharge methods that must be assessed to find the best possible option for the site. The hierarchy is as follows:

1. Discharge to the ground using SuDS/infiltration features.
2. Discharge to a watercourse.
3. Discharge to a sewer, this level can be further split down to discharge to a surface water sewer and discharge to a combined/foul water sewer, the former being on top.

When designing a drainage system all the parts of the hierarchy must be assessed in order, discounting options that are not viable for the site until the best possible option is selected for the development scheme.

Applying the hierarchy to this site:

1. A formal ground investigation for the site has not been completed however the BGS mapping shows that the ground is unsuitable for infiltration techniques. This does not preclude the use of SuDS features earlier in the management train, just not as the final point of discharge.
2. There is a watercourse that is on the eastern boundary of the site. It is believed that some of the hardstanding areas currently discharge to this watercourse. As this is viable it is likely to be the option that is put forward.
3. It is believed that the current method of discharge for the site is to a combined sewer that runs in Main Street. A CCTV survey will be needed to confirm the point of discharge for the current buildings and hardstanding.

Although the current site is believed to discharge to the combined sewer, this is the least desirable option on the hierarchy. There is also a watercourse that bounds the site. A scheme that discharges to the watercourse should be developed going forward. In order to limit the

developments effects on the watercourse and the potential flooding, the rates of discharge should be limited to Greenfield run-off rate (or as close as reasonably practical). It is believed that part of the site's hardstanding areas may run-off to the watercourse.

5.3 Proposed Discharge Rate

This site is a brownfield site, it is believed that the surface and foul water currently discharges to the combined sewer network that runs in Kirkby Lane/Main Street//Manor Lane, with part of the hardstanding areas running off to the watercourse. Of the two options, the higher option on the hierarchy is to use the watercourse, to which the site should be discharged at greenfield run-off rate or as close as reasonably practical. As a summary of appendix H & as an expansion of this:

Site area is 0.193ha

| IH124 Method | 50ha | 0.193ha |
|---|---|---|
| 1 in 1 year | 191.1 l/s | 0.7 l/s |
| Qbar | 219.7 l/s | 0.9 l/s |
| 1 in 30 year | 527.7 l/s | 2.0 l/s |
| 1 in 100 year | 782.0 l/s | 3.0 l/s |

When using the IH124 Method you need to input a site area of 50ha and then pro rata the figure down to the desired site area. As you can see the rates produced are very low and are not reasonably practical for maintenance and operation, therefore a figure of 5 l/s should be used. As there is likely existing run-off from the hardstanding areas to the watercourse, 5 l/s should still be a reduction in the flow that is discharged to the watercourse.

5.4 Surface Water Flood Risk

The site is located in flood zone 1 for rivers and seas and the site topography shows that there is a fall from the back of the site in the north to the main road in the south, the gradient is approximately 1 in 33. There is also a small fall across the site, from west to east, towards the watercourse. There is a section of the site that is within an area of pluvial flood risk however the dwellings have been directed towards areas outside these areas and the rear gardens areas are located within this zone instead. As a result of this there is no need to set the FFL level above current flood levels. However, if it is possible to set FFLs slightly above surrounding levels to direct any water away from dwellings, this should be done.

5.5 Surface Water Strategy

The outline surface water system has been designed to discharge to the adjacent watercourse at a rate of 5 l/s.

The RWPs from the roof areas of the buildings should be connected to the main system that runs to an attenuation tank in the rear of the plots 2 and 3, this is then connected to watercourse described earlier in the report. The water will be limited a flow control device to a maximum of 5 l/s up to the 1 in 100 year event with 40% climate change (1% AEP event). The road area will be a mix of impermeable asphalt for the main drive area and permeable block paving for the parking bay areas. The road will be impermeable as the current area is asphalt and it is far more sustainable to retain existing construction then it is to replace. The parking areas will be a Type C 'tanked' permeable construction to allow water that falls off the cars to soak through the surface of the bays to the sub-base below. This will provide filtration for this water before it is discharge to the system and on to the watercourse. This process mimics the natural processes compared to the traditional pipe and gully system. After the attenuation tank there will be an inspection chamber that has a flow control device in it (we suggest an orifice with a removable baffle plate) which will cause the water to back up into the attenuation tank. Finally, the water will be discharged to the watercourse via a GRP or PCC headwall fitted with either a non-return valve or a flap valve. This headwall may require consent from the LLFA if the profile of the watercourse is changed and an obstruction is caused, specific requirements can be found in section 23 of the Land Drainage Act 1991, also the general binding rules of headwalls should be followed. These permissions, if required, should be in place prior to installation.

5.6 Foul Water Strategy

Once the scheme has been fully developed and the dwelling layouts are finalised, the foul water system can be completely designed. The system should receive the foul water from "pop up" locations connected to a main run, which should then be connected to the combined sewer in the main road.

If the foul water system cuts through the any permeable paving it will need to be sealed to ensure water is contained in the sub-base of the paving areas.

If the existing site doesn't discharge to the sewer, or the rate of discharge to the sewer is to increase, Section 106 consent will be needed from Severn Trent.

5.7 For details of the surface water system please appendix I and J for the drainage scheme and calculations respectively.

5.8 Considering that the site in flood zone 1 and the dwellings have been moved outside of any modelled flood areas, it is deemed unnecessary to provide flood resistance and resilient measures such as raising the plug socket levels to above flood depths, as the site is highly unlikely to be flooded.

5.9 In Summary, the surface water systems should be designed to control to greenfield run-off rate (or close as reasonably practical) and store the 1 in 100 year plus 40% climate change event (1% AEP), discharging to the watercourse that is adjacent to the eastern boundary of the site. The foul water should be designed to discharge to the combined sewer running in main road.

## 6.0 Maintenance Plan

6.1 Responsibility of the maintenance will depend on whether the SuDS feature is to be adopted or is to remain in private ownership. There are a number of potential owners of the responsibility which can include land owners, water authorities, management companies, etc.

6.2 It is important to understand who is responsible for the maintenance of a system to ensure that important maintenance actions are not missed and ultimately, the system continues to operate and does not fail, leading to flood.

6.3 In this case, the system is in private ownership areas. Private systems including the storage crates and permeable paving will be the responsibly of owners of the properties, they could set up Management Company which is paid for by the residents.

6.4 The table below shows the parts of the system that are SuDS features, it then identifies the maintenance actions that need to occur.

| Component of the system | Regular Maintenance | Occasional Maintenance | Remedial Maintenance |
|---|---|---|---|
| Permeable paving | Regular maintenance | Brushing and vacuuming (standard cosmetic sweep over whole surface). | Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment. |
| | | Stabilise and mow contributing and adjacent areas. | As required. |
| | Occasional maintenance | Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying. | As required – once per year on less frequently used pavements. |

| | | | |
|---|---|---|---|
| | | Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving. | As required. |
| | Remedial Actions | Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material. | As required. |
| | | Rehabilitation of surface and upper substructure by remedial sweeping. | Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging. |
| | Monitoring | Initial inspection. | Monthly for three months after installation. |
| | | Inspect for evidence of poor operation and/or weed growth – if required, take remedial action. | Three-monthly, 48 h after large storms in first six months. |
| | | Inspect silt accumulation rates and establish appropriate brushing frequencies. | Annually. |
| | | Monitor inspection chambers. | Annually. |
| Pipe System and Controls | Regular maintenance | Inspect and identify any areas that areas that are not operating correctly. If required, take remedial action. | Monthly for 3 months, then annually. |
| | | Remove debris from the catchment surface (where it may cause risks to performance) | Monthly. |
| | Remedial Actions | Repair/rehabilitate inlets, outlets and overflows. | As required. |
| | Monitoring | Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed. | Annually. |

6.5 As can be seen in the table there are three primary types of maintenance, they are

1. Regular maintenance
2. Occasional maintenance
3. Remedial maintenance

6.6 Regular maintenance needs to be carried out monthly or after each rainfall event during the first year of use and then the maintenance regime can fall into a regular pattern, say every 3 months with greater emphasis in Autumn when leaf fall occurs. Occasional maintenance needs to occur with less frequency than the regular maintenance but still needs to follow a regime to ensure the feature operates as intended and with efficiency. Remedial maintenance is only required when needed, such as when damage has been caused to the drainage system

6.7 Further information on the types of maintenance and the maintenance actions themselves can be found it the CIRIA report C753 – The SuDS Manual in chapter 32 – Operation and maintenance which is freely available for download from www.ciria.org.

## 7.0 Conclusions

7.1 The site is located in flood zone 1, as identified by the EA using their 'Map for Planning' and within the Hinckley & Bosworth Borough Council Level 1 SFRA.

The site has passed the sequential test as the site located in flood zone 1 and in the more vulnerable classification, this is acceptable for flood risk.

The site is partially at risk at low risk of surface water flooding; however, the site layout has been developed to steer the dwellings away from these areas.

The site, overall, is considered to be at low risk of flooding from any sources, as there aren't any viable sources to cause it.

7.2 The site should have 40% climate changed applied to it.

The site has should be limited to a greenfield run-off rate or as close as possible, it is likely that the existing hard paved areas run-off to the watercourse at an unrestricted rate, therefore by limited the flow and creating a positive outfall arrangement it will likely reduce the rate of discharge.

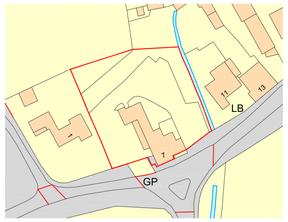
The surface water drainage system should be designed to control and store up to the 1 in 100 year plus 40% climate change event (1% AEP).

# Appendices

- *A: Location Plan*
- *B: EA Flood Maps & Guidance*
- *C: BGS Mapping Extracts*
- *D:DEFRA Magic Map Extracts*
- *E: Gov.uk Long Term Flood Risk Extracts*
- *F: Severn Trent Sewer Records*
- *G: H & B Borough Council Level 1 SFRA Extracts*
- *H: Discharge Rate Calculations*
- *I: Outline Drainage Strategy Drawing*
- *J: Drainage Details*
- *K: Drainage Calculations*

# Appendix A

A1 Drawing Sheet

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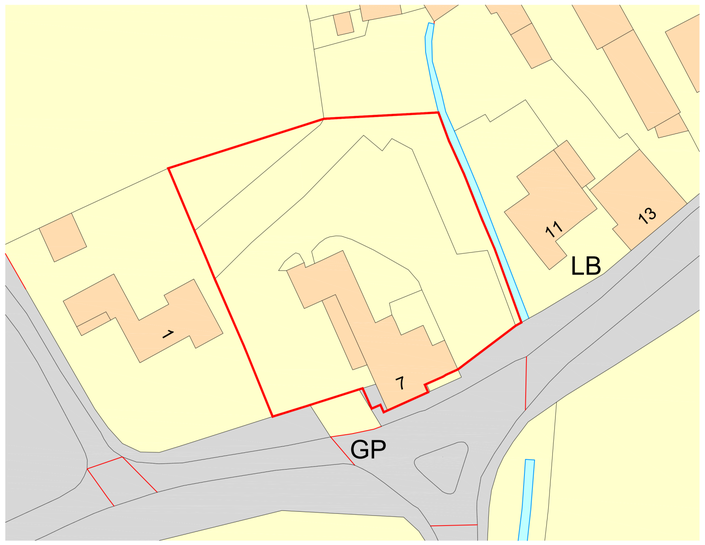
# Location Plan Scale 1:1250

0 10 20 30 40 50
Scale (m)

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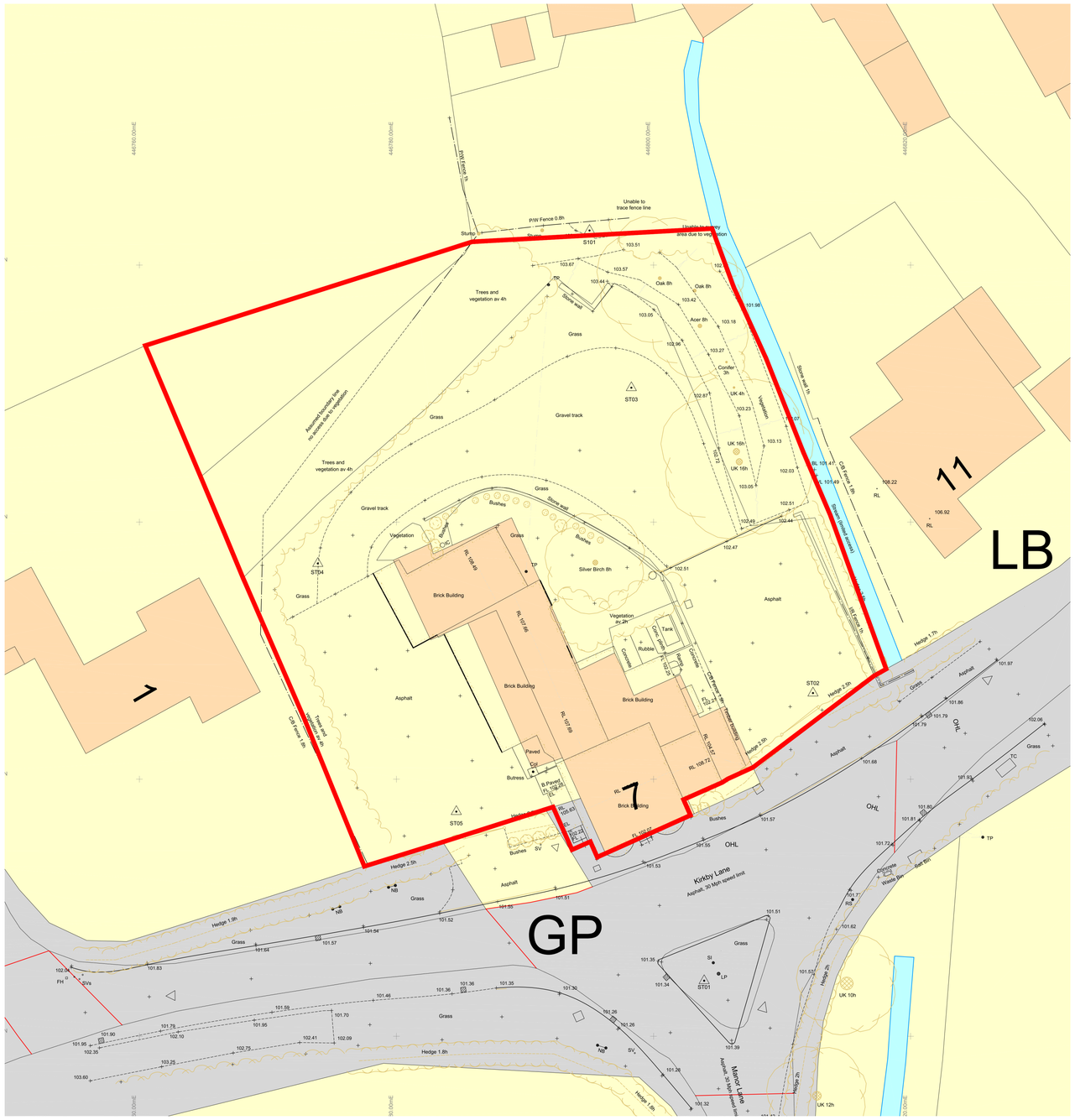
# Block Plan Scale 1:500

0 5 10 15 20 25
Scale (m)




# Existing Site Plan Scale 1:200

0 2 4 6 8 10
Scale (m)

CLIENT:
Steve and Craig Brooker

PROJECT:
New Residential Development at:
7 Main Street
Peckleton
Leicester
LE9 7RE

DRAWING: 1310.SS.23.001

ISSUE: A

DATE: Jan 2023

SCALE: 1:200, 1:500 & 1:1250

PLANNING APPLICATION:

LOCATION PLANS

UTOPIA
ARCHITECTURAL DESIGN STUDIO

# Appendix B

Environment Agency

# Flood map for planning

| Your reference | Location (easting/northing) | Created |
| --- | --- | --- |
| **20-16136** | **446794/301035** | **21 Oct 2020 11:59** |

**Your selected location is in flood zone 1, an area with a low probability of flooding.**

## This means:

- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

### Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

The Open Government Licence sets out the terms and conditions for using government data.
https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/

Environment Agency

**Flood map for planning**

Your reference
**20-16136**

Location (easting/northing)
**446794/301035**

Scale
**1:2500**

Created
**21 Oct 2020 11:59**

- Selected point
- Flood zone 3
- Flood zone 3: areas benefitting from flood defences
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Flood storage area

0 20 40 60m



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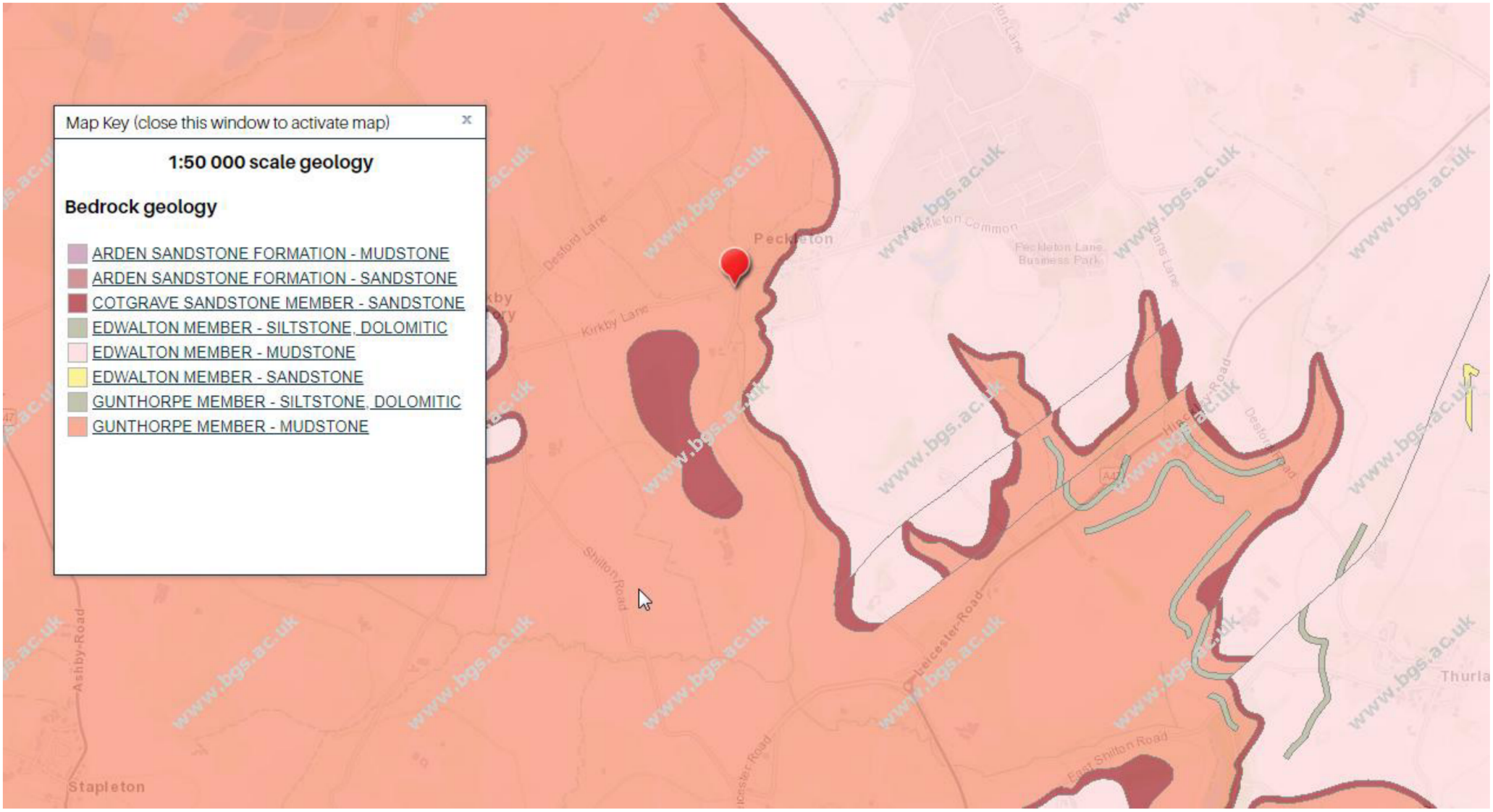
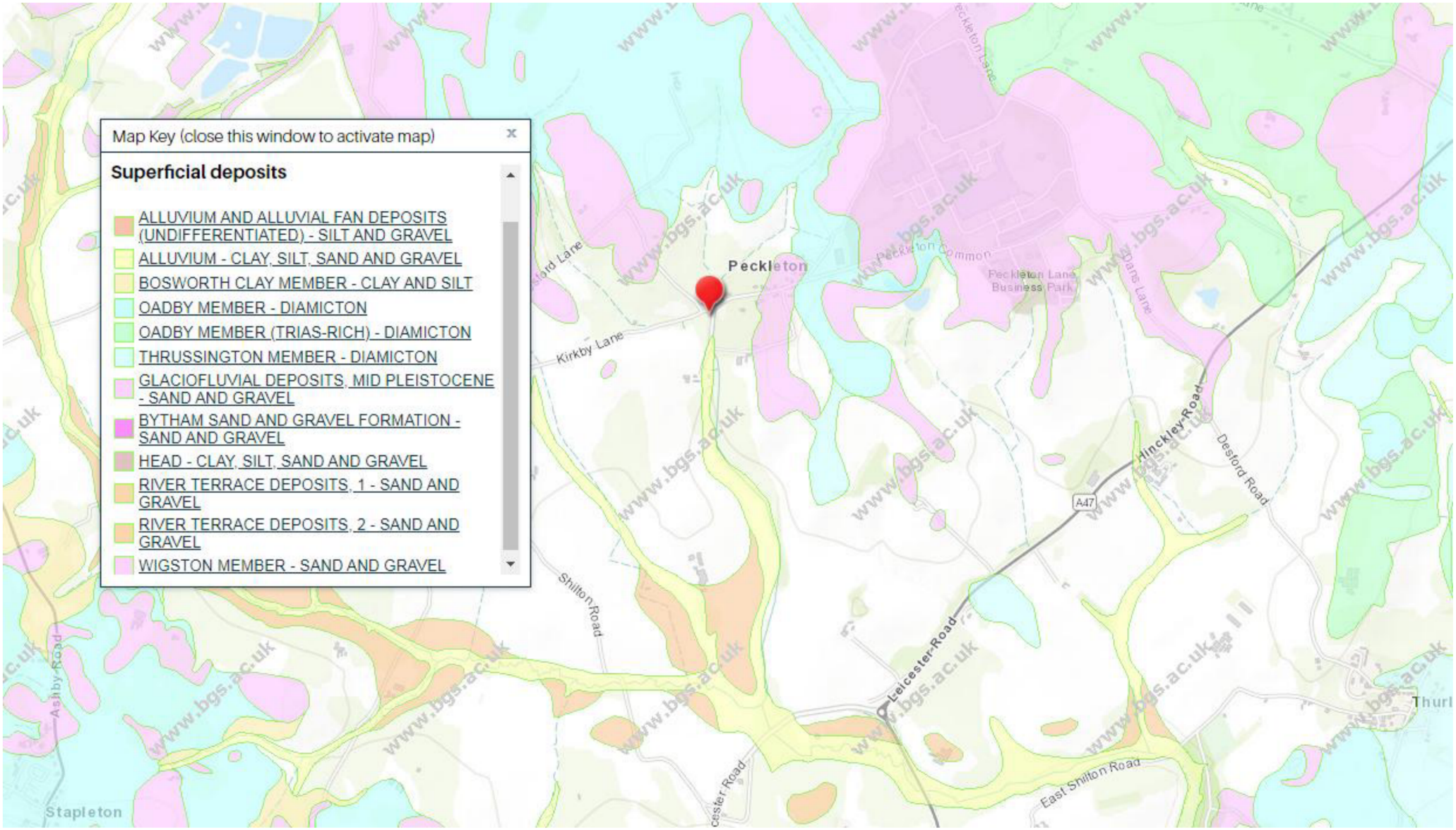
# Appendix C

**BGS Geology of Britain Map Extract – Showing the bedrock**

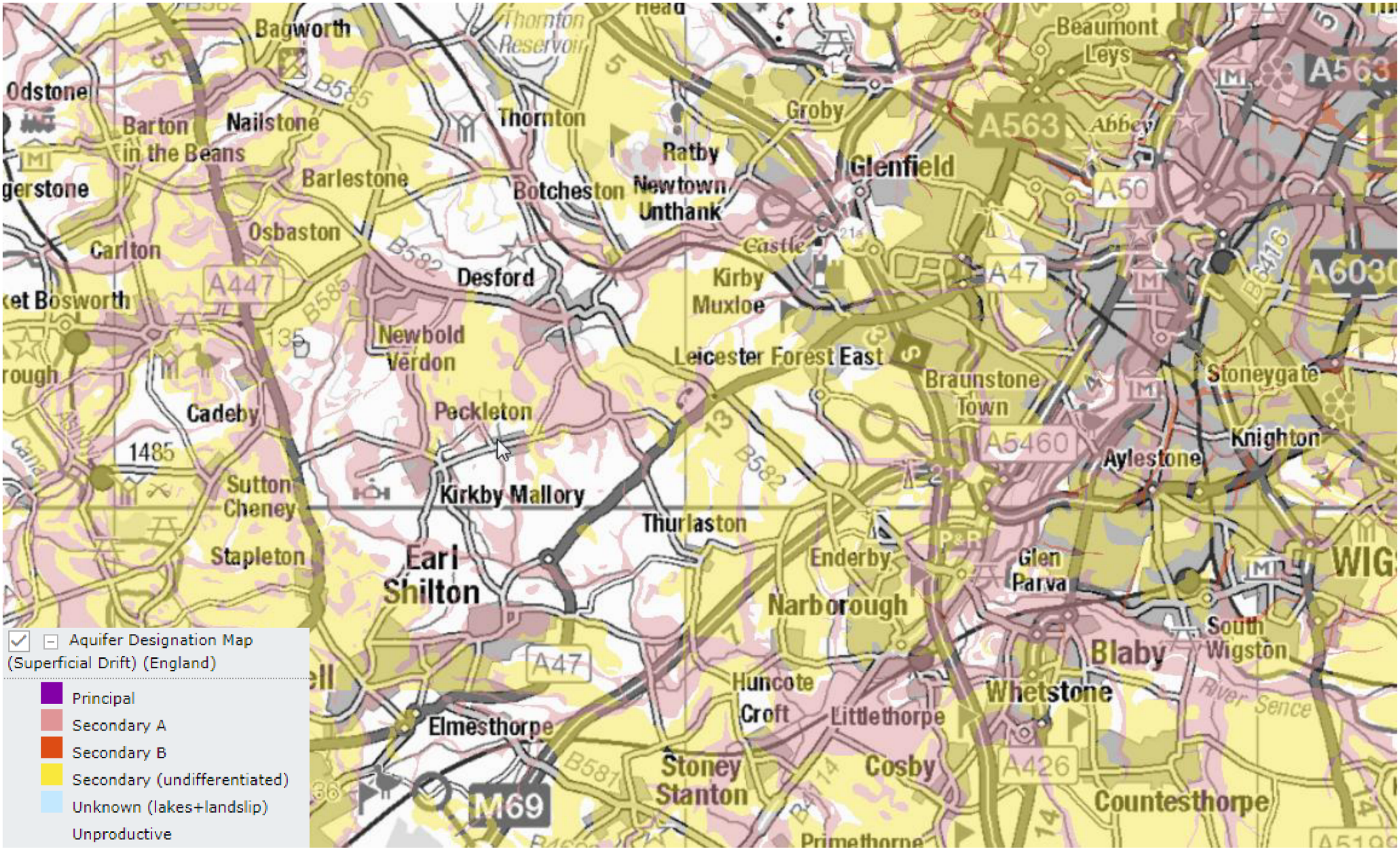


**BGS Geology of Britain Map Extract – Showing the superficial deposits**

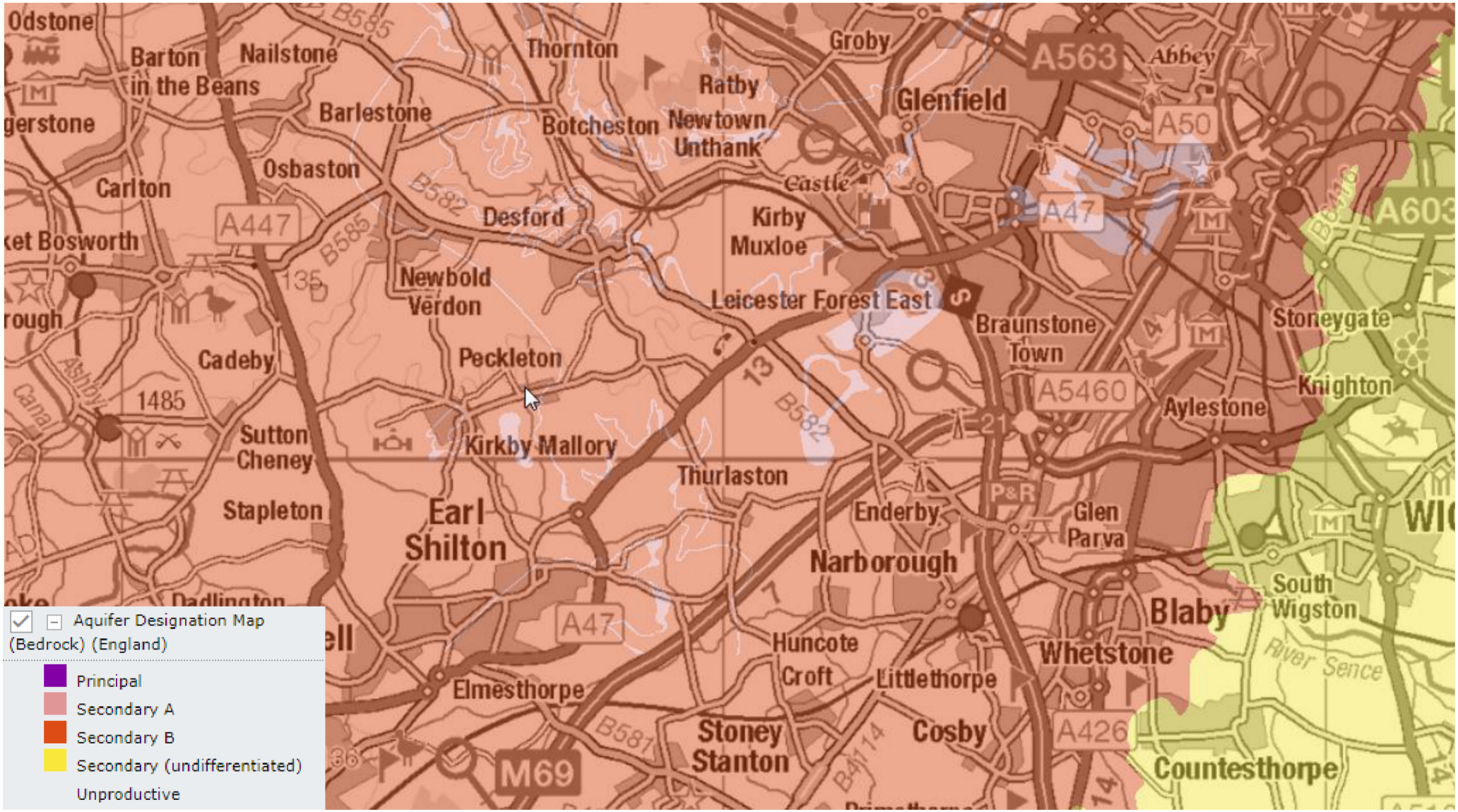


# Appendix D

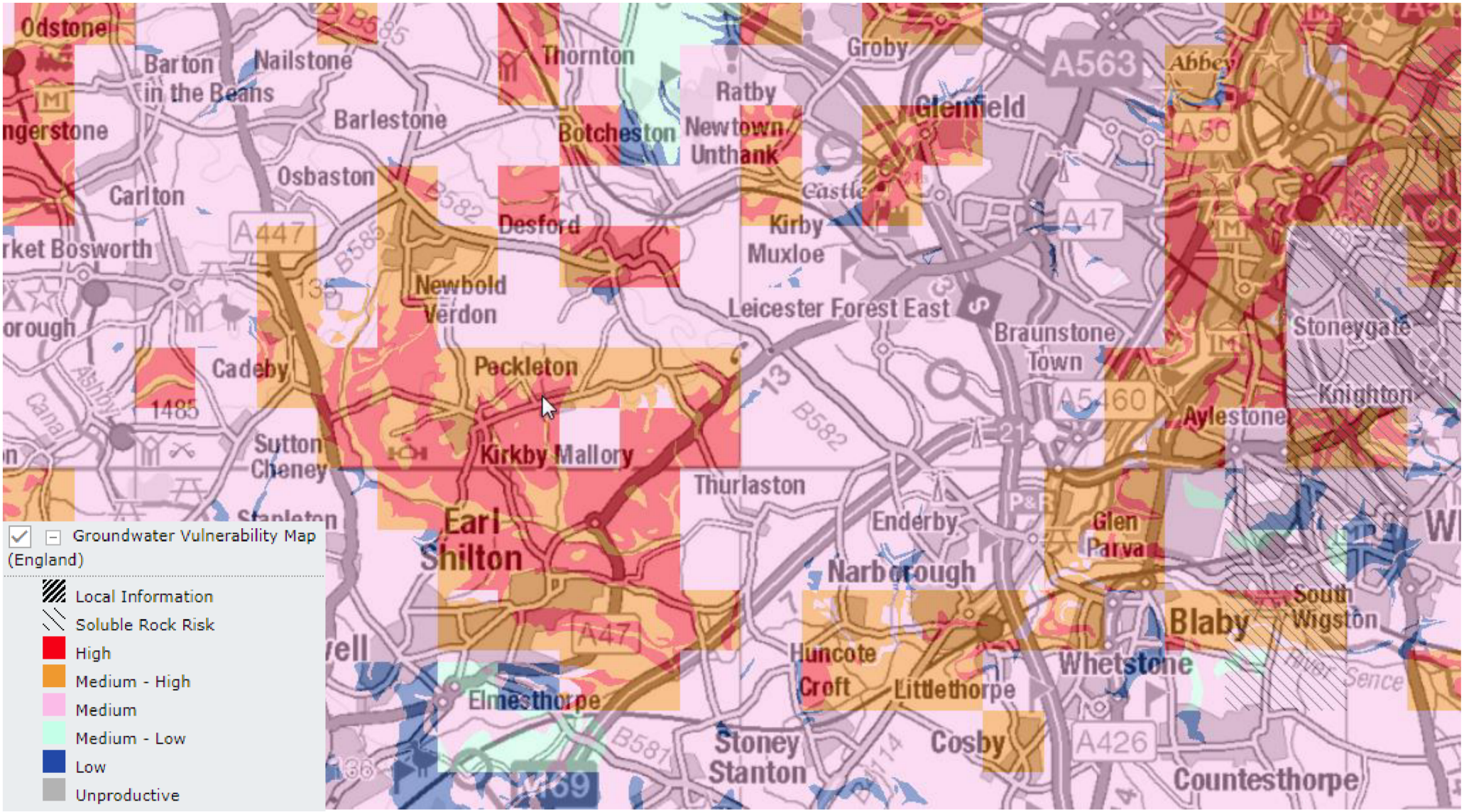
**DEFRA Magic Map Extract – showing superficial deposits designations**



**DEFRA Magic Map Extract – showing bedrock designations**



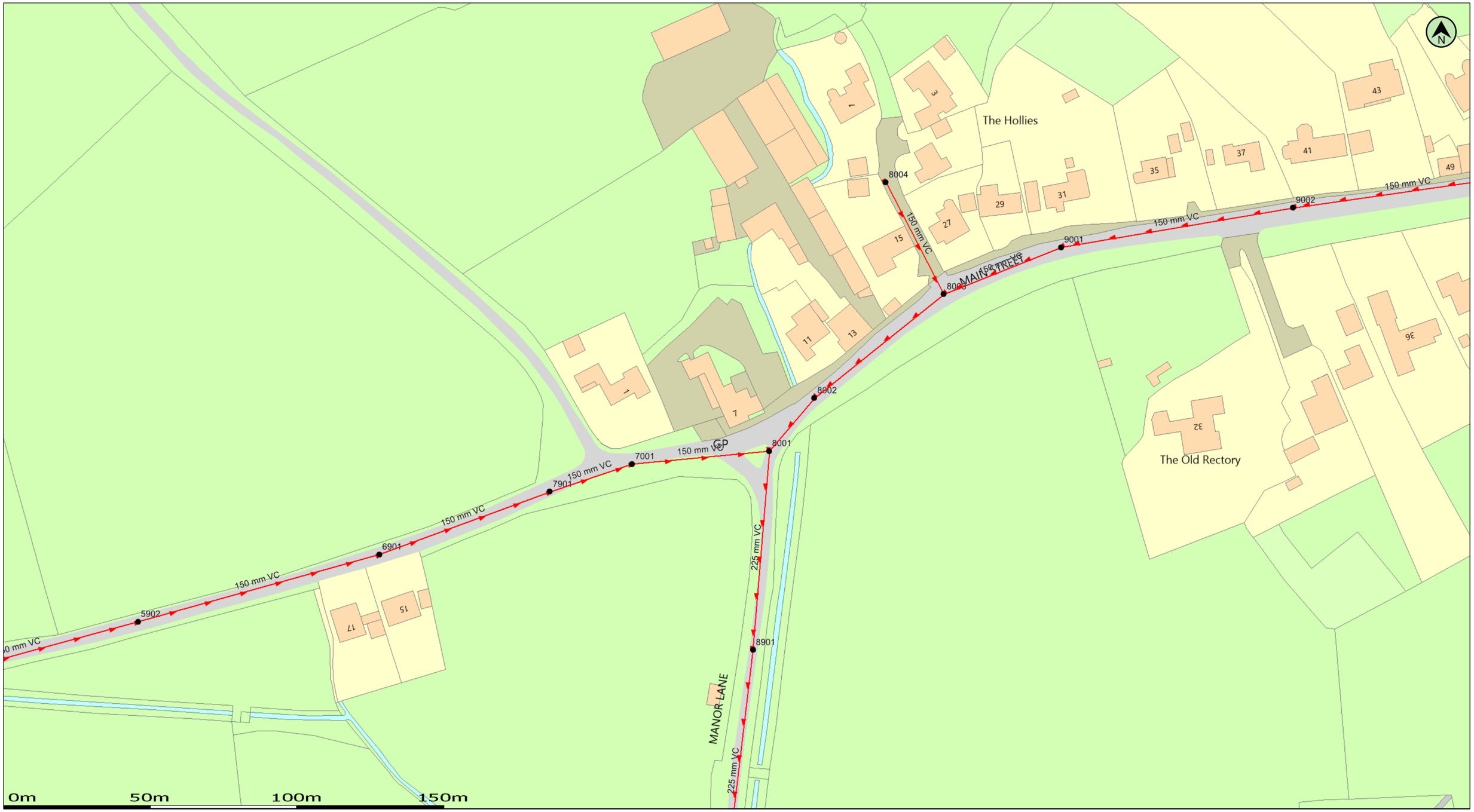
**DEFRA Magic Map Extract – showing groundwater vulnerabilities**



# Appendix E

**Gov.uk Long Term Flood Risk Map Extract – showing surface water flooding risk**

# Appendix F




(c) Crown copyright and database rights 2020 Ordnance Survey 100031673 | Date: 21/10/20 | Scale: 1:1250 | Map Centre: 446799,301022 | Data updated: 14/10/20 | Our Ref: 450004 - 1 | Wastewater Plan A3

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| | | | | | |
|---|---|---|---|---|---|
| Public Foul Gravity/Lateral Drain | | Highway Drain | | Manhole Foul | ● |
| Public Combined Gravity/Lateral Drain | | Overflow Pipe | | Manhole Surface | ○ |
| Public Surface Water Gravity/Lateral Drain | | Disposal Pipe | | Abandoned Pipe | |
| Pressure Foul | | Culverted Water Course | | Section 104 sewers are shown in green | |
| Pressure Combined | | Pumping Station | ▲ ▲ ▲ | Private sewers are shown in magenta | |
| Pressure Surface Water | | Fitting | ■ | | |

r.shimmings@diamondwoodandshaw.co

16136 Little India

SEVERN TRENT

**GENERAL CONDITIONS AND PRECAUTIONS TO BE TAKEN WHEN CARRYING OUT WORK ADJACENT TO SEVERN TRENT WATER'S APPARATUS**

Please ensure that a copy of these conditions is passed to your representative and/or your contractor on site. If any damage is caused to Severn Trent Water Limited (STW) apparatus (defined below), the person, contractor or subcontractor responsible must inform STW immediately on:
**0800 783 4444 (24 hours)**

a) These general conditions and precautions apply to the public sewerage, water distribution and cables in ducts including (but not limited to) sewers which are the subject of an Agreement under Section 104 of the Water Industry Act 1991(a legal agreement between a developer and STW, where a developer agrees to build sewers to an agreed standard, which STW will then adopt); mains installed in accordance with an agreement for the self-construction of water mains entered into with STW and the assets described at condition b) of these general conditions and precautions. Such apparatus is referred to as “STW Apparatus” in these general conditions and precautions.

b) Please be aware that due to The Private Sewers Transfer Regulations June 2011, the number of public sewers has increased, but many of these are not shown on the public sewer record. However, some idea of their positions may be obtained from the position of inspection covers and their existence must be anticipated.

c) On request, STW will issue a copy of the plan showing the approximate locations of STW Apparatus although in certain instances a charge will be made. The position of private drains, private sewers and water service pipes to properties are not normally shown but their presence must be anticipated. This plan and the information supplied with it is furnished as a general guide only and STW does not guarantee its accuracy.

d) STW does not update these plans on a regular basis. Therefore the position and depth of STW Apparatus may change and this plan is issued subject to any such change. Before any works are carried out, you should confirm whether any changes to the plan have been made since it was issued.

e) The plan must not be relied upon in the event of excavations or other works in the vicinity of STW Apparatus. It is your responsibility to ascertain the precise location of any STW Apparatus prior to undertaking any development or other works (including but not limited to excavations).

f) No person or company shall be relieved from liability for loss and/or damage caused to STW Apparatus by reason of the actual position and/or depths of STW Apparatus being different from those shown on the plan.

In order to achieve safe working conditions adjacent to any STW Apparatus the following should be observed:

1. All STW Apparatus should be located by hand digging prior to the use of mechanical excavators.

2. All information set out in any plans received from us, or given by our staff at the site of the works, about the position and depth of the mains, is approximate. Every possible precaution should be taken to avoid damage to STW Apparatus. You or your contractor must ensure the safety of STW Apparatus and will be responsible for the cost of repairing any loss and/or damage caused (including without limitation replacement parts).

3. Water mains are normally laid at a depth of 900mm. No records are kept of customer service pipes which are normally laid at a depth of 750mm; but some idea of their positions may be obtained from the position of stop tap covers and their existence must be anticipated.

4. During construction work, where heavy plant will cross the line of STW Apparatus, specific crossing points must be agreed with STW and suitably reinforced where required. These crossing points should be clearly marked and crossing of the line of STW Apparatus at other locations must be prevented.

5. Where it is proposed to carry out piling or boring within 20 metres of any STW Apparatus, STW should be consulted to enable any affected STW Apparatus to be surveyed prior to the works commencing.

6. Where excavation of trenches adjacent to any STW Apparatus affects its support, the STW Apparatus must be supported to the satisfaction of STW. Water mains and some sewers are pressurised and can fail if excavation removes support to thrust blocks to bends and other fittings.

7. Where a trench is excavated crossing or parallel to the line of any STW Apparatus, the backfill should be adequately compacted to prevent any settlement which could subsequently cause damage to the STW Apparatus. In special cases, it may be necessary to provide permanent support to STW Apparatus which has been exposed over a length of the excavation before backfilling and reinstatement is carried out. There should be no concrete backfill in contact with the STW Apparatus.

8. No other apparatus should be laid along the line of STW Apparatus irrespective of clearance. Above ground apparatus must not be located within a minimum of 3 metres either side of the centre line of STW Apparatus for smaller sized pipes and 6 metres either side for larger sized pipes without prior approval. No manhole or chamber shall be built over or around any STW Apparatus.

9. A minimum radial clearance of 300 millimetres should be allowed between any plant or equipment being installed and existing STW Apparatus. We reserve the right to increase this distance where strategic assets are affected.

10. Where any STW Apparatus coated with a special wrapping is damaged, even to a minor extent, STW must be notified and the trench left open until the damage has been inspected and the necessary repairs have been carried out. In the case of any material damage to any STW Apparatus causing leakage, weakening of the mechanical strength of the pipe or corrosion-protection damage, the necessary remedial work will be recharged to you.

11. It may be necessary to adjust the finished level of any surface boxes which may fall within your proposed construction. Please ensure that these are not damaged, buried or otherwise rendered inaccessible as a result of the works and that all stop taps, valves, hydrants, etc. remain accessible and operable. Minor reduction in existing levels may result in conflict with STW Apparatus such as valve spindles or tops of hydrants housed under the surface boxes. Checks should be made during site investigations to ascertain the level of such STW Apparatus in order to determine any necessary alterations in advance of the works.

12. With regard to any proposed resurfacing works, you are required to contact STW on the number given above to arrange a site inspection to establish the condition of any STW Apparatus in the nature of surface boxes or manhole covers and frames affected by the works. STW will then advise on any measures to be taken, in the event of this a proportionate charge will be made.

13. You are advised that STW will not agree to either the erection of posts, directly over or within 1.0 metre of valves and hydrants,

14. No explosives are to be used in the vicinity of any STW Apparatus without prior consultation with STW.

**TREE PLANTING RESTRICTIONS**

There are many problems with the location of trees adjacent to sewers, water mains and other STW Apparatus and these can lead to the loss of trees and hence amenity to the area which many people may have become used to. It is best if the problem is not created in the first place. Set out below are the recommendations for tree planting in close proximity to public sewers, water mains and other STW Apparatus.

15. Please ensure that, in relation to STW Apparatus, the mature root systems and canopies of any tree planted do not and will not encroach within the recommended distances specified in the notes below.

16. Both Poplar and Willow trees have extensive root systems and should not be planted within 12 metres of a sewer, water main or other STW Apparatus.

17. The following trees and those of similar size, be they deciduous or evergreen, should not be planted within 6 metres of a sewer, water main or other STW Apparatus. E.g. Ash, Beech, Birch, most Conifers, Elm, Horse Chestnut, Lime, Oak, Sycamore, Apple and Pear. Asset Protection Statements Updated May 2014

18. STW personnel require a clear path to conduct surveys etc. No shrubs or bushes should be planted within 2 metre of the centre line of a sewer, water main or other STW Apparatus.

19. In certain circumstances, both STW and landowners may wish to plant shrubs/bushes in close proximity to a sewer, water main of other STW Apparatus for screening purposes. The following are shallow rooting and are suitable for this purpose: Blackthorn, Broom, Cotoneaster, Elder, Hazel, Laurel, Privet, Quickthorn, Snowberry, and most ornamental flowering shrubs.

| Manhole Reference | Liquid Type | Cover Level | Invert Level | Depth to Invert |
|---|---|---|---|---|
| 5902 | C | 103.8 | 102.03 | 1.77 |
| 6901 | C | 103.78 | 101.4 | 2.38 |
| 7001 | C | 101.63 | 100.11 | 1.52 |
| 7901 | C | 103.36 | 100.66 | 2.7 |
| 8001 | C | 101.3 | 99.51 | 1.79 |
| 8002 | C | 101.78 | 100.02 | 1.76 |
| 8003 | C | - | 0 | 0 |
| 8004 | C | 103.21 | 101.98 | 1.23 |
| 8901 | C | 100.95 | 98.97 | 1.98 |
| 9001 | C | 105.77 | 103.91 | 1.86 |
| 9002 | C | 111.07 | 109.51 | 1.56 |

| Manhole Reference | Liquid Type | Cover Level | Invert Level | Depth to Invert |
|---|---|---|---|---|

| Manhole Reference | Liquid Type | Cover Level | Invert Level | Depth to Invert |
|---|---|---|---|---|

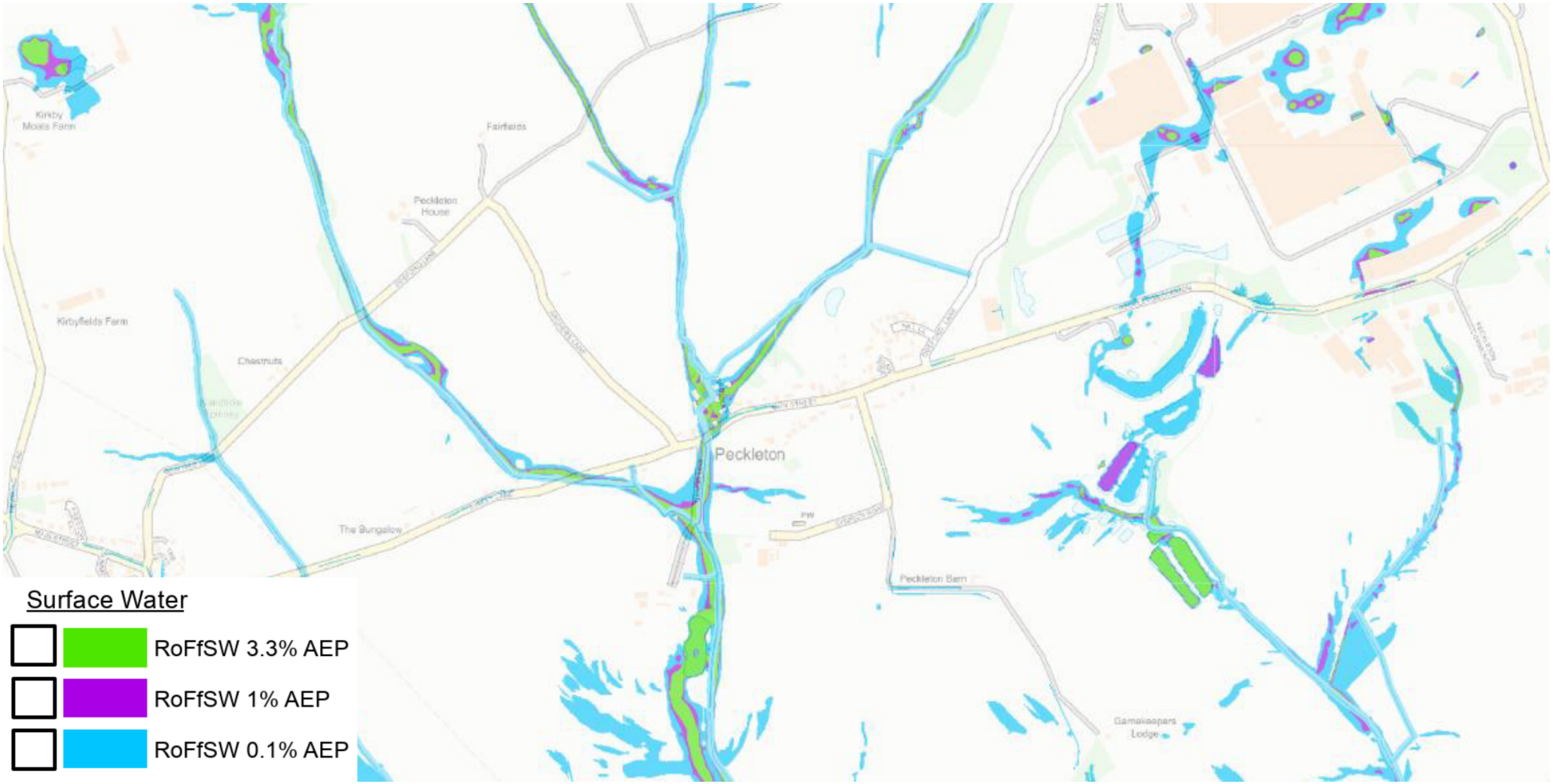
| | | | | |
|---|---|---|---|---|
| | | | | |

| | | | | |
|---|---|---|---|---|
| | | | | |

| | | | | |
|---|---|---|---|---|
| | | | | |

# Appendix G

**Hinckley & Bosworth Borough Council Level 1 SFRA Map Extract – showing surface water flooding risk & watercourses**



# Appendix H

## IH 124 Mean Annual Flood

Input

| | | | |
|---|---|---|---|
| Return Period (years) | 2 | Soil | 0.450 |
| Area (ha) | 50.000 | Urban | 0.000 |
| SAAR (mm) | 700 | Region Number | Region 5 |

| **Results** | **l/s** |
|---|---|
| QBAR Rural | 219.7 |
| QBAR Urban | 219.7 |
| Q2 years | 196.3 |
| Q1 year | 191.1 |
| Q2 years | 196.3 |
| Q5 years | 283.4 |
| Q10 years | 363.5 |
| Q20 years | 459.3 |
| Q25 years | 496.9 |
| Q30 years | 527.7 |
| Q50 years | 624.3 |
| Q100 years | 782.0 |
| Q200 years | 920.4 |
| Q250 years | 964.3 |
| Q1000 years | 1265.2 |

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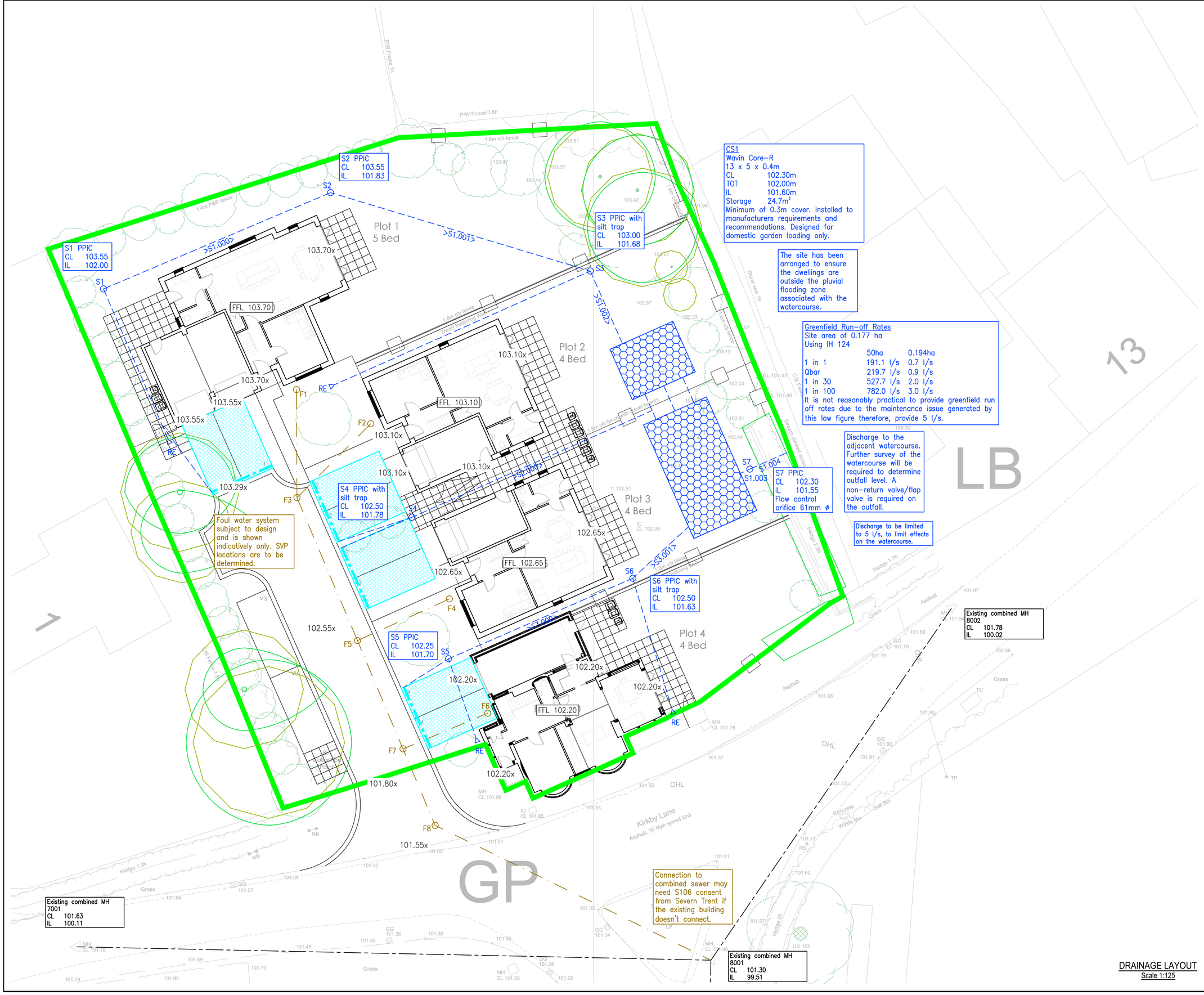
# Appendix I




CS1
Wavin Core-R
13 x 5 x 0.4m
CL 102.30m
TOT 102.00m
IL 101.60m
Storage 24.7m³
Minimum of 0.3m cover. Installed to manufacturers requirements and recommendations. Designed for domestic garden loading only.

The site has been arranged to ensure the dwellings are outside the pluvial flooding zone associated with the watercourse.

Greenfield Run-off Rates
Site area of 0.177 ha
Using IH 124

| | 50ha | 0.194ha |
|---|---|---|
| 1 in 1 | 191.1 l/s | 0.7 l/s |
| Qbar | 219.7 l/s | 0.9 l/s |
| 1 in 30 | 527.7 l/s | 2.0 l/s |
| 1 in 100 | 782.0 l/s | 3.0 l/s |

It is not reasonably practical to provide greenfield run off rates due to the maintenance issue generated by this low figure therefore, provide 5 l/s.

Discharge to the adjacent watercourse. Further survey of the watercourse will be required to determine outfall level. A non-return valve/flap valve is required on the outfall.

Discharge to be limited to 5 l/s, to limit effects on the watercourse.

DRAINAGE LAYOUT
Scale 1:125

DO NOT SCALE

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NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER DWS DRAWINGS, CALCULATIONS, REPORTS AND SPECIFICATIONS (WHERE APPLICABLE) AND, ALL OTHER RELEVANT ENGINEERS, ARCHITECTS & SPECIALIST DESIGN DETAILS.
2. STANDARD NOTES & DETAILS:
   Refer to drawing number 0-170 onwards for standard notes – CIVIL
   Refer to drawing number 0-180 onwards for standard details – CIVIL

SCALE BAR TEST
1:125 — 7m @ 1:125 — 1:125

All dimensions to be verified by accurate site measurement prior to commencing work or ordering materials.

KEY

- Surface Water Pipe (Adoptable)
- Surface Water Pipe (Private)
- Surface Water Pipe (Perforated)
- Surface Water Rising Main (Adoptable)
- Surface Water Rising Main (Private)
- Surface Water Pipe (Lateral)
- Surface Water Chamber (Adoptable)
- Surface Water Chamber (Private)
- Rodding Eye
- Gully
- Linear Drain
- Attenuation Tank
- Soakaway
- Permeable Paving
- Fin Drain
- Foul Water Pipe (Adoptable)
- Foul Water Pipe (Private)
- Foul Water Rising Main (Adoptable)
- Foul Water Rising Main (Private)
- Foul Water Pipe (Lateral)
- Foul Water Chamber (Adoptable)
- Foul Water Chamber (Private)
- Back Inlet Gully/Foul Gully
- Combined Water Pipe (Adoptable)
- Combined Water Pipe (Private)
- Combined Water Rising Main (Adoptable)
- Combined Water Rising Main (Private)
- Combined Water Chamber (Adoptable)
- Combined Water Chamber (Private)
- Exceedence Flow Route
- Concrete Pipe Protection
- Sewer Easement
- Existing Surface Water Sewer
- Existing Foul Water Sewer
- Existing Combined Water Sewer
- Root Protection Area
- Site Boundary

| Ref | Revision | Date | By |
|---|---|---|---|
| P3 | Fin Drains added | 01.12.23 | LM |
| P2 | Permeable paving extents added | 28.11.23 | LM |
| P1 | First issue | 16.10.23 | LM |

NOT FOR CONSTRUCTION

Issue
PRELIMINARY

DWS Consulting Engineers

Diamond Wood & Shaw Limited
The Old School • Blaby Road • Enderby • Leicester • LE19 4AR
Tel: 0116 284 8989 • Email: mail@dwsltd.co.uk

Project Title
LITTLE INDIA RESTAURANT,
7 MAIN STREET
PECKLETON

| Drawn | Engineer | Checked |
|---|---|---|
| LM | LM | RAS |

| Scale at | Date |
|---|---|
| 1:125 @ A1 | OCT 2023 |

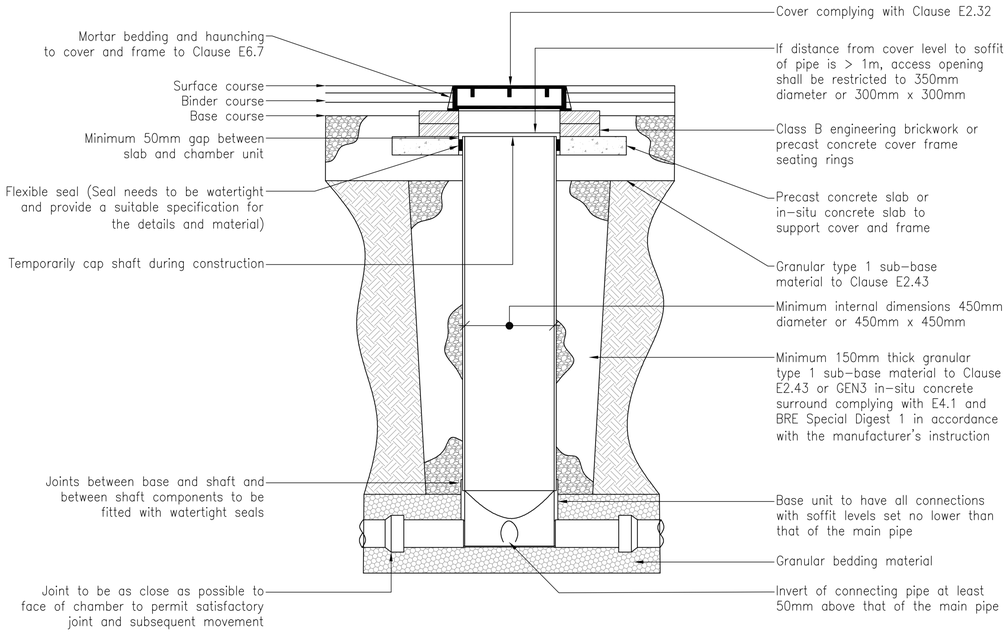
Drawing Title
DRAINAGE LAYOUT

| Project No. | Drawing No. | Revision |
|---|---|---|
| 23-20082 | 0-500 | P3 |

BIM Code

# Appendix J

Plastic chambers and ring shall comply with Clause E2.31.



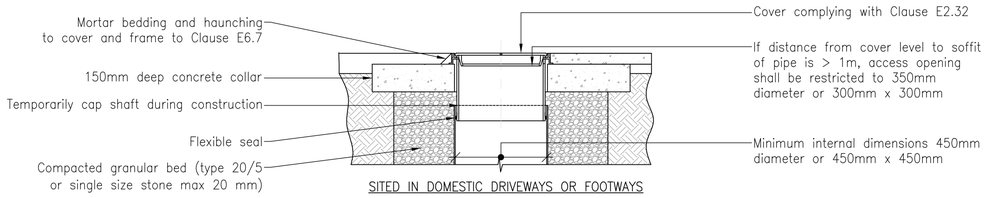

Note: Where the access chamber is in the highway (including any footway) the Highway Authority can have specific requirements

## TYPICAL INSPECTION CHAMBER DETAIL - TYPE D

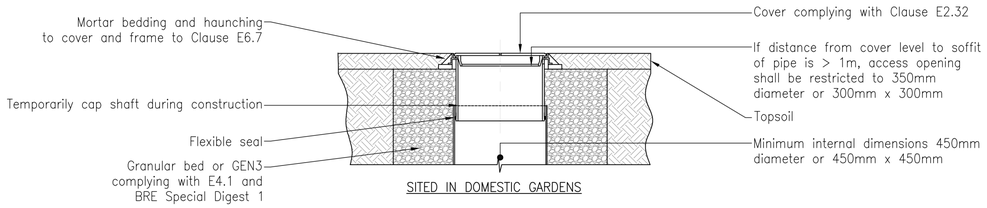
Scale 1:20

Depth from cover level to soffit of pipe up to 3m
Flexible material construction for use in areas subject to vehicle loading

Plastic chambers and rings shall comply with clause E2.31




SITED IN DOMESTIC DRIVEWAYS OR FOOTWAYS



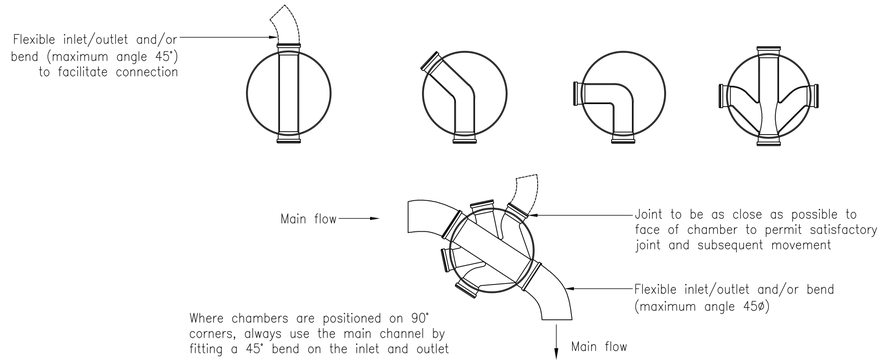

SITED IN DOMESTIC GARDENS

Note: Where the access chamber is in the highway (including any footway), the Highway Authority can have specific requirements.

## ALTERNATIVE TOP DETAILS FOR TYPE D CHAMBERS

Scale 1:20

Flexible material alternative top details for use in areas of light vehicle loading or landscaped areas

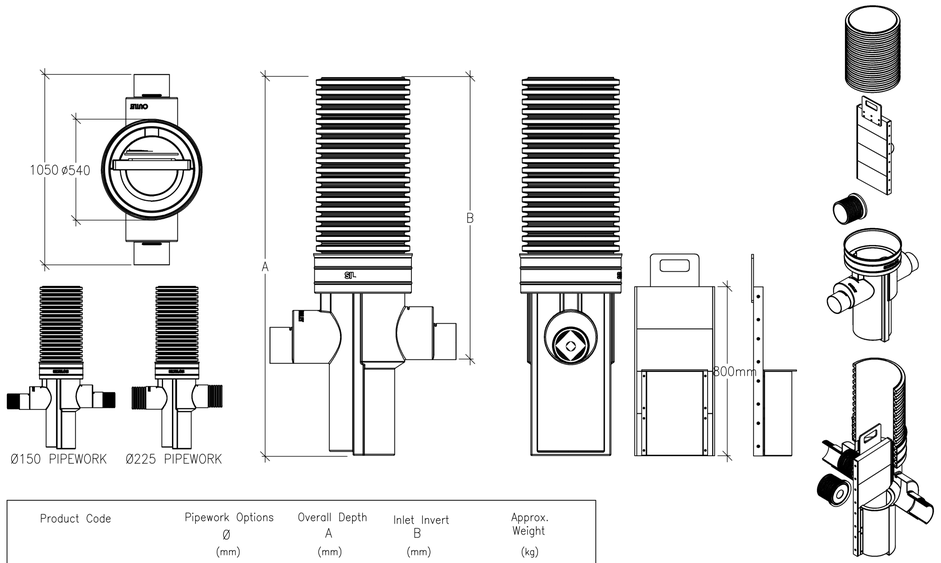



Where chambers are positioned on 90° corners, always use the main channel by fitting a 45° bend on the inlet and outlet

Note: Where a bend is used immediately outside the manhole, this may be used as the rocker pipe.

## TYPICAL BASE LAYOUTS FOR TYPE D CHAMBERS

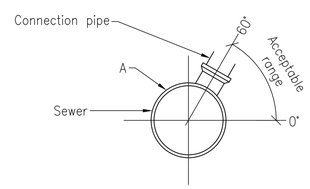
Scale 1:20



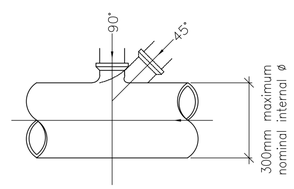

| Product Code | Pipework Options Ø (mm) | Overall Depth A (mm) | Inlet Invert B (mm) | Approx. Weight (kg) |
|---|---|---|---|---|
| OFCC500/1.5 | 150–225 | 1480 | 965 | 34 |
| OFCC500/2 | 150–225 | 1990 | 1475 | 39 |
| OFCC500/2.4 | 150–225 | 2400 | 1885 | 44 |
| OFCC500/3 | 150–225 | 3000 | 2485 | 50 |

## TYPICAL PROTECTED ORIFLO INSPECTION CHAMBER DETAIL

NTS




CROSS-SECTIONAL VIEW OF SEWER




PLAN VIEWED IN DIRECTION OF ARROW - A

## CONNECTION TO SEWER

## DRAINAGE DETAILS - SHEET 1

Scale 1:20

DO NOT SCALE

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2. STANDARD NOTES & DETAILS:
   Refer to drawing number 0–170 onwards for standard notes – CIVIL
   Refer to drawing number 0–180 onwards for standard details – CIVIL

| Ref | Revision | Date | By |
|---|---|---|---|
| P1 | First issue | 28.11.23 | LM |

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Issue: PRELIMINARY

DWS Consulting Engineers
Diamond Wood & Shaw Limited
The Old School • Blaby Road • Enderby • Leicester • LE19 4AR
Tel: 0116 284 8989 • Email: mail@dwsltd.co.uk

Project Title: LITTLE INDIA RESTAURANT, 7 MAIN STREET PECKLETON

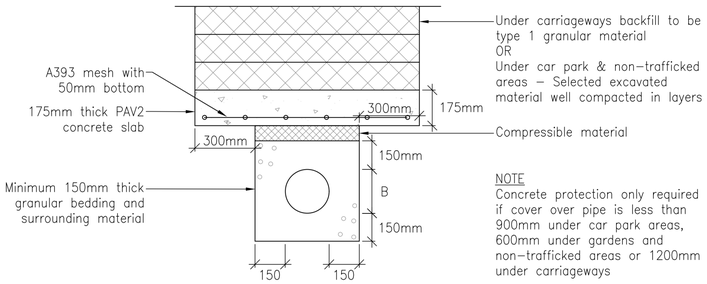
| Drawn | Engineer | Checked |
|---|---|---|
| LM | LM | RAS |

| Scale at | Date |
|---|---|
| 1:20 @ A1 | NOV 2023 |

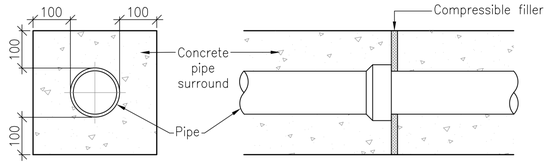
Drawing Title: DRAINAGE DETAILS - SHEET 1

| Project No. | Drawing No. | Revision |
|---|---|---|
| 23-20082 | 0-180 | P1 |

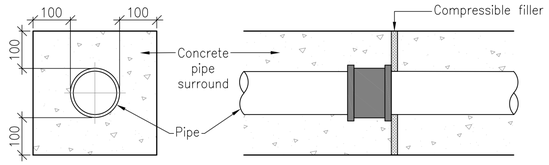
BIM Code




NOTE
Concrete protection only required if cover over pipe is less than 900mm under car park areas, 600mm under gardens and non-trafficked areas or 1200mm under carriageways

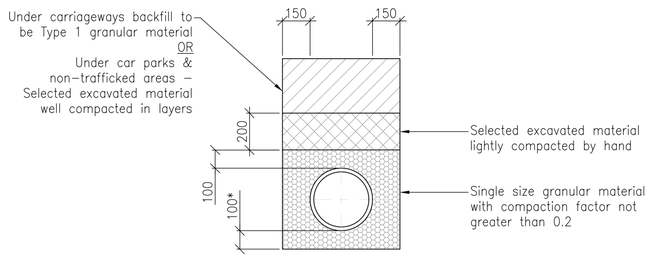



SPIGOT AND SOCKET JOINT




SLEEVE JOINT

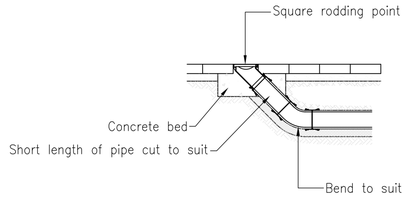
## PROTECTION OF PIPES LAID AT SHALLOW DEPTHS



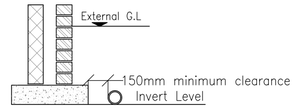

* Class 'S' bedding depth to be 1/6 pipe dia. or 100mm, whichever is the greater.

| Nominal Pipe Size DN (mm) | Pipe Bedding Requirement Size of Aggregate (mm) |
|---|---|
| 150<br>225 – 525 | 14 to 5<br>20 to 5 |

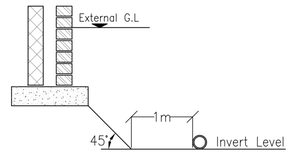
## CLASS S BEDDING
Scale 1:20




## RODDING POINT

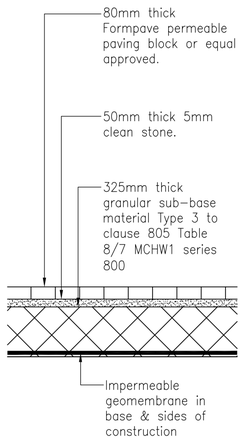



Foundation less than 1m from Public Sewer:
Carry Foundations down below invert level of Sewer




Foundation more than 1m from Public Sewer:
Angle of 45 degrees can be taken from a point 1m clear of the Sewer up to the required footing level.

## BUILDING WITHIN 3M OF DRAIN



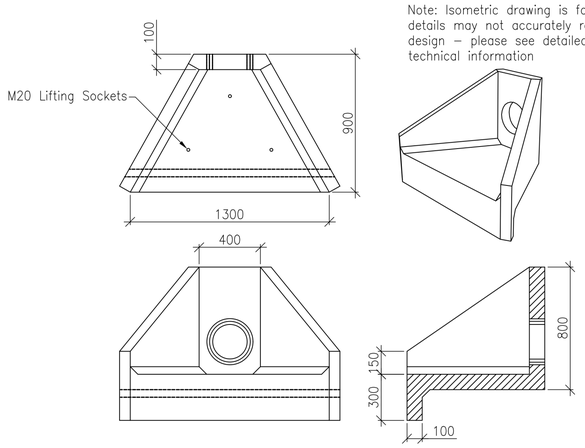

## PERMEABLE DRIVEWAY CONSTRUCTION
(Suitable for cars and light vehicle use)

Notes:
1. Permeable paving parking bays to be installed to the manufacturers recommendations and requirements.
2. The designs are based to a CBR value of 2–3%. On site testing should be carried out to determine CBR value before construction. A capping layer beneath geomembrane may be required if CBR is low.
3. Prior to construction, a check on the ground's frost susceptibility should be made. If prone, a minimum of 450mm depth construction must be provided for all hard surfaced areas. This will be achieved using capping (6F5 or equal approved) material to bring the overall depth to 450mm.

Road sub-base layer

| CBR value | Sub-base |
|---|---|
| less than 2% | Subgrade requires improvement |
| 2–3% | 325mm |
| 3–5% | 250mm |
| 5 to 7% | 150mm |
| 7 to 20% | 100mm |

The top 450mm has to be materials that are not frost susceptible




Note: Isometric drawing is for reference only, details may not accurately represent actual design – please see detailed views for technical information

## ALTHON H3C HEADWALL

## DRAINAGE DETAILS - SHEET 2
Scale 1:20

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2. STANDARD NOTES & DETAILS:
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Refer to drawing number 0–180 onwards for standard details – CIVIL

| Ref | Revision | Date | By |
|---|---|---|---|
| P2 | Updated geomembrane on build up | 01.12.23 | LM |
| P1 | First issue | 28.11.23 | LM |

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Issue
PRELIMINARY

DWS
Consulting Engineers
Diamond Wood & Shaw Limited
The Old School • Blaby Road • Enderby • Leicester • LE19 4AR
Tel: 0116 284 8989 • Email: mail@dwsltd.co.uk

Project Title
LITTLE INDIA RESTAURANT,
7 MAIN STREET
PECKLETON

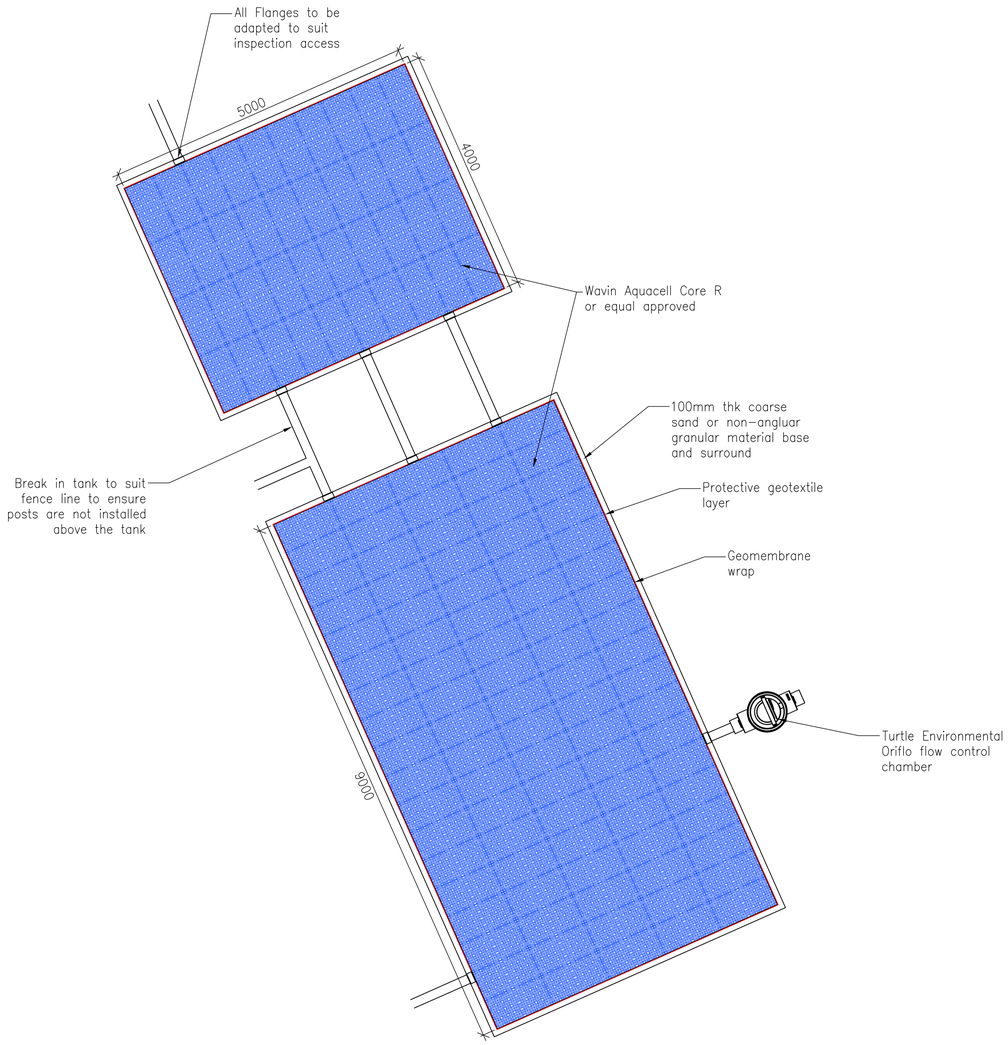
| Drawn | Engineer | Checked |
|---|---|---|
| LM | LM | RAS |

| Scale at | Date |
|---|---|
| 1:20 @ A1 | NOV 2023 |

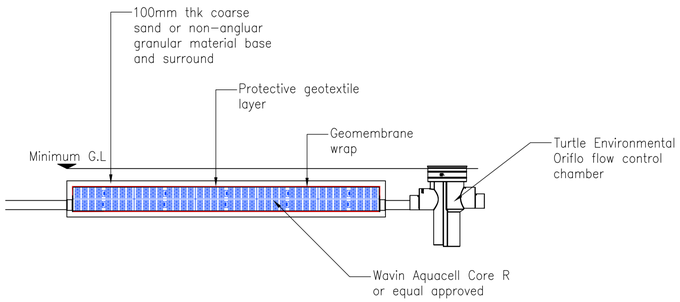
Drawing Title
DRAINAGE DETAILS - SHEET 2

| Project No. | Drawing No. | Revision |
|---|---|---|
| 23-20082 | 0-181 | P2 |

BIM Code




ATTENUATION TANK PLAN DETAIL
Scale 1:50




ATTENUATION TANK CROSS-SECTION
Scale 1:50

DRAINAGE DETAILS - SHEET 3
Scale 1:50

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| Ref | Revision | Date | By |
|---|---|---|---|
| P1 | First issue | 28.11.23 | LM |

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Project Title
LITTLE INDIA RESTAURANT,
7 MAIN STREET
PECKLETON

| Drawn | Engineer | Checked |
|---|---|---|
| LM | LM | RAS |

| Scale at | Date |
|---|---|
| 1:50 @ A1 | NOV 2023 |

Drawing Title
DRAINAGE DETAILS - SHEET 3
ATTENUATION TANK DETAILS

| Project No. | Drawing No. | Revision |
|---|---|---|
| 23-20082 | 0-182 | P1 |

BIM Code

# Appendix K

Diamond Wood & Shaw Limited
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# Drainage Calculations

| | |
|---|---|
| Client: | S & S Contracting Ltd |
| Architect: | Mair Land & Planning Consultants Ltd |
| Project: | Little India Restaurant, 7 Main Street, Peckleton |
| Project No: | 23-20082 |
| Document No: | 0-010 |
| Issue: | Rev P1: October 2023 |
| Status: | Preliminary |
| Date: | 16/10/2023 |
| Engineer: | LM |

Issue Status:
A=Approval
B=Building Regulations
C=Construction
D=Draft
P=Preliminary
R=Review
T=Tender
Z=Final Construction

## STORM SEWER DESIGN by the Modified Rational Method

### Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

| | | | |
|---|---|---|---|
| Return Period (years) | 100 | PIMP (%) | 100 |
| M5-60 (mm) | 20.000 | Add Flow / Climate Change (%) | 0 |
| Ratio R | 0.400 | Minimum Backdrop Height (m) | 0.200 |
| Maximum Rainfall (mm/hr) | 50 | Maximum Backdrop Height (m) | 1.500 |
| Maximum Time of Concentration (mins) | 30 | Min Design Depth for Optimisation (m) | 1.200 |
| Foul Sewage (l/s/ha) | 0.000 | Min Vel for Auto Design only (m/s) | 1.00 |
| Volumetric Runoff Coeff. | 0.750 | Min Slope for Optimisation (1:X) | 500 |

Designed with Level Soffits

### Network Design Table for Storm

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 17.890 | 0.170 | 105.2 | 0.007 | 4.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| 1.001 | 16.680 | 0.150 | 111.2 | 0.000 | 0.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| 1.002 | 5.760 | 0.080 | 72.0 | 0.020 | 0.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| 2.000 | 18.070 | 0.180 | 100.4 | 0.018 | 4.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| 3.000 | 14.590 | 0.070 | 208.4 | 0.027 | 4.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| 3.001 | 5.510 | 0.030 | 183.7 | 0.006 | 0.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| 1.003 | 0.750 | 0.050 | 15.0 | 0.000 | 0.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |
| 1.004 | 2.920 | 0.050 | 58.4 | 0.000 | 0.00 | 0.0 | 0.600 | o | 150 | Pipe/Conduit | |

### Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 50.00 | 4.30 | 102.000 | 0.007 | 0.0 | 0.0 | 0.0 | 0.98 | 17.3 | 0.9 |
| 1.001 | 50.00 | 4.60 | 101.830 | 0.007 | 0.0 | 0.0 | 0.0 | 0.95 | 16.8 | 0.9 |
| 1.002 | 50.00 | 4.68 | 101.680 | 0.027 | 0.0 | 0.0 | 0.0 | 1.19 | 21.0 | 3.7 |
| 2.000 | 50.00 | 4.30 | 101.780 | 0.018 | 0.0 | 0.0 | 0.0 | 1.00 | 17.7 | 2.4 |
| 3.000 | 50.00 | 4.35 | 101.700 | 0.027 | 0.0 | 0.0 | 0.0 | 0.69 | 12.2 | 3.7 |
| 3.001 | 50.00 | 4.48 | 101.630 | 0.033 | 0.0 | 0.0 | 0.0 | 0.74 | 13.0 | 4.5 |
| 1.003 | 50.00 | 4.68 | 101.600 | 0.078 | 0.0 | 0.0 | 0.0 | 2.61 | 46.2 | 10.6 |
| 1.004 | 50.00 | 4.72 | 101.550 | 0.078 | 0.0 | 0.0 | 0.0 | 1.32 | 23.3 | 10.6 |

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## Manhole Schedules for Storm

| MH Name | MH CL (m) | MH Depth (m) | MH Connection | MH Diam.,L*W (mm) | PN | Pipe Out Invert Level (m) | Diameter (mm) | PN | Pipes In Invert Level (m) | Diameter (mm) | Backdrop (mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S1 | 103.550 | 1.550 | Open Manhole | 450 | 1.000 | 102.000 | 150 | | | | |
| S2 | 103.550 | 1.720 | Open Manhole | 450 | 1.001 | 101.830 | 150 | 1.000 | 101.830 | 150 | |
| S3 | 103.000 | 1.320 | Open Manhole | 450 | 1.002 | 101.680 | 150 | 1.001 | 101.680 | 150 | |
| S4 | 102.500 | 0.720 | Open Manhole | 450 | 2.000 | 101.780 | 150 | | | | |
| S5 | 102.250 | 0.550 | Open Manhole | 450 | 3.000 | 101.700 | 150 | | | | |
| S6 | 102.500 | 0.870 | Open Manhole | 450 | 3.001 | 101.630 | 150 | 3.000 | 101.630 | 150 | |
| CS1 | 102.300 | 0.700 | Open Manhole | 1200 | 1.003 | 101.600 | 150 | 1.002 | 101.600 | 150 | |
| | | | | | | | | 2.000 | 101.600 | 150 | |
| | | | | | | | | 3.001 | 101.600 | 150 | |
| S7 | 102.300 | 0.750 | Open Manhole | 450 | 1.004 | 101.550 | 150 | 1.003 | 101.550 | 150 | |
| Outfall | 102.000 | 0.500 | Open Manhole | 0 | | OUTFALL | | 1.004 | 101.500 | 150 | |

No coordinates have been specified, layout information cannot be produced.

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## PIPELINE SCHEDULES for Storm

### Upstream Manhole

| PN | Hyd Sect | Diam (mm) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| 1.000 | o | 150 | S1 | 103.550 | 102.000 | 1.400 | Open Manhole | 450 |
| 1.001 | o | 150 | S2 | 103.550 | 101.830 | 1.570 | Open Manhole | 450 |
| 1.002 | o | 150 | S3 | 103.000 | 101.680 | 1.170 | Open Manhole | 450 |
| 2.000 | o | 150 | S4 | 102.500 | 101.780 | 0.570 | Open Manhole | 450 |
| 3.000 | o | 150 | S5 | 102.250 | 101.700 | 0.400 | Open Manhole | 450 |
| 3.001 | o | 150 | S6 | 102.500 | 101.630 | 0.720 | Open Manhole | 450 |
| 1.003 | o | 150 | CS1 | 102.300 | 101.600 | 0.550 | Open Manhole | 1200 |
| 1.004 | o | 150 | S7 | 102.300 | 101.550 | 0.600 | Open Manhole | 450 |

### Downstream Manhole

| PN | Length (m) | Slope (1:X) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| 1.000 | 17.890 | 105.2 | S2 | 103.550 | 101.830 | 1.570 | Open Manhole | 450 |
| 1.001 | 16.680 | 111.2 | S3 | 103.000 | 101.680 | 1.170 | Open Manhole | 450 |
| 1.002 | 5.760 | 72.0 | CS1 | 102.300 | 101.600 | 0.550 | Open Manhole | 1200 |
| 2.000 | 18.070 | 100.4 | CS1 | 102.300 | 101.600 | 0.550 | Open Manhole | 1200 |
| 3.000 | 14.590 | 208.4 | S6 | 102.500 | 101.630 | 0.720 | Open Manhole | 450 |
| 3.001 | 5.510 | 183.7 | CS1 | 102.300 | 101.600 | 0.550 | Open Manhole | 1200 |
| 1.003 | 0.750 | 15.0 | S7 | 102.300 | 101.550 | 0.600 | Open Manhole | 450 |
| 1.004 | 2.920 | 58.4 | Outfall | 102.000 | 101.500 | 0.350 | Open Manhole | 0 |

## Free Flowing Outfall Details for Storm

| Outfall Pipe Number | Outfall Name | C. Level (m) | I. Level (m) | Min I. Level (m) | D,L (mm) | W (mm) |
|---|---|---|---|---|---|---|
| 1.004 | Outfall | 102.000 | 101.500 | 0.000 | 0 | 0 |

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## Simulation Criteria for Storm

| | | | |
|---|---|---|---|
| Volumetric Runoff Coeff | 0.750 | Additional Flow - % of Total Flow | 0.000 |
| Areal Reduction Factor | 1.000 | MADD Factor * 10m³/ha Storage | 2.000 |
| Hot Start (mins) | 0 | Inlet Coeffiecient | 0.800 |
| Hot Start Level (mm) | 0 | Flow per Person per Day (l/per/day) | 0.000 |
| Manhole Headloss Coeff (Global) | 0.500 | Run Time (mins) | 60 |
| Foul Sewage per hectare (l/s) | 0.000 | Output Interval (mins) | 1 |

| | | | |
|---|---|---|---|
| Number of Input Hydrographs | 0 | Number of Storage Structures | 1 |
| Number of Online Controls | 1 | Number of Time/Area Diagrams | 0 |
| Number of Offline Controls | 0 | Number of Real Time Controls | 0 |

## Synthetic Rainfall Details

| | | | |
|---|---|---|---|
| Rainfall Model | FSR | Profile Type | Summer |
| Return Period (years) | 100 | Cv (Summer) | 0.750 |
| Region | England and Wales | Cv (Winter) | 0.840 |
| M5-60 (mm) | 20.000 | Storm Duration (mins) | 30 |
| Ratio R | 0.400 | | |

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## Online Controls for Storm

### Orifice Manhole: S7, DS/PN: 1.004, Volume ($m^3$): 0.1

Diameter (m) 0.061 Discharge Coefficient 0.600 Invert Level (m) 101.550

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## Storage Structures for Storm

### Cellular Storage Manhole: CS1, DS/PN: 1.003

Invert Level (m) 101.600 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

| Depth (m) | Area (m²) | Inf. Area (m²) | Depth (m) | Area (m²) | Inf. Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 65.0 | 65.0 | 0.401 | 0.0 | 79.4 |
| 0.400 | 65.0 | 79.4 | | | |

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## 1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

### Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

### Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.400
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status OFF
Inertia Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) |
|---|---|---|---|---|---|---|---|---|---|
| 1.000 | S1 | 15 Winter | 1 | +0% | | | | | 102.025 |
| 1.001 | S2 | 15 Winter | 1 | +0% | 100/60 Winter | | | | 101.855 |
| 1.002 | S3 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 101.725 |
| 2.000 | S4 | 15 Winter | 1 | +0% | 100/30 Winter | | | | 101.820 |
| 3.000 | S5 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 101.761 |
| 3.001 | S6 | 15 Winter | 1 | +0% | 30/30 Winter | | | | 101.699 |
| 1.003 | CS1 | 60 Winter | 1 | +0% | 30/15 Winter | | | | 101.670 |
| 1.004 | S7 | 30 Winter | 1 | +0% | 30/15 Summer | | | | 101.696 |

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume (m³) | Flow / Cap. | Overflow (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|---|
| 1.000 | S1 | -0.125 | 0.000 | 0.06 | | | 1.0 | OK | |
| 1.001 | S2 | -0.125 | 0.000 | 0.07 | | | 1.0 | OK | |
| 1.002 | S3 | -0.105 | 0.000 | 0.19 | | | 3.3 | OK | |

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## 1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume (m³) | Flow / Cap. | Overflow (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|---|
| 2.000 | S4 | -0.110 | 0.000 | 0.16 | | | 2.7 | OK | |
| 3.000 | S5 | -0.089 | 0.000 | 0.35 | | | 4.0 | OK | |
| 3.001 | S6 | -0.081 | 0.000 | 0.43 | | | 4.6 | OK | |
| 1.003 | CS1 | -0.080 | 0.000 | 0.17 | | 30 | 2.4 | OK | |
| 1.004 | S7 | -0.004 | 0.000 | 0.16 | | | 2.3 | OK | |

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## 30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

### Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

### Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.400
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status OFF
Inertia Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) |
|---|---|---|---|---|---|---|---|---|---|
| 1.000 | S1 | 15 Winter | 30 | +0% | | | | | 102.039 |
| 1.001 | S2 | 15 Winter | 30 | +0% | 100/60 Winter | | | | 101.870 |
| 1.002 | S3 | 60 Winter | 30 | +0% | 100/15 Summer | | | | 101.795 |
| 2.000 | S4 | 15 Winter | 30 | +0% | 100/30 Winter | | | | 101.845 |
| 3.000 | S5 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 101.832 |
| 3.001 | S6 | 60 Winter | 30 | +0% | 30/30 Winter | | | | 101.796 |
| 1.003 | CS1 | 60 Winter | 30 | +0% | 30/15 Winter | | | | 101.793 |
| 1.004 | S7 | 60 Winter | 30 | +0% | 30/15 Summer | | | | 101.892 |

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume (m³) | Flow / Cap. | Overflow (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|---|
| 1.000 | S1 | -0.111 | 0.000 | 0.16 | | | 2.5 | OK | |
| 1.001 | S2 | -0.110 | 0.000 | 0.16 | | | 2.5 | OK | |
| 1.002 | S3 | -0.035 | 0.000 | 0.27 | | | 4.7 | OK | |

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## 30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume (m³) | Flow / Cap. | Overflow (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|---|
| 2.000 | S4 | -0.085 | 0.000 | 0.39 | | | 6.5 | OK | |
| 3.000 | S5 | -0.018 | 0.000 | 0.83 | | | 9.3 | OK | |
| 3.001 | S6 | 0.016 | 0.000 | 0.52 | | | 5.6 | SURCHARGED | |
| 1.003 | CS1 | 0.043 | 0.000 | 0.28 | | 48 | 3.9 | SURCHARGED | |
| 1.004 | S7 | 0.192 | 0.000 | 0.24 | | | 3.3 | SURCHARGED | |

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## 100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

### Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

### Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.400
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status OFF
Inertia Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) |
|---|---|---|---|---|---|---|---|---|---|
| 1.000 | S1 | 15 Winter | 100 | +40% | | | | | 102.054 |
| 1.001 | S2 | 60 Winter | 100 | +40% | 100/60 Winter | | | | 101.989 |
| 1.002 | S3 | 60 Winter | 100 | +40% | 100/15 Summer | | | | 101.987 |
| 2.000 | S4 | 60 Winter | 100 | +40% | 100/30 Winter | | | | 101.989 |
| 3.000 | S5 | 15 Winter | 100 | +40% | 100/15 Summer | | | | 102.041 |
| 3.001 | S6 | 60 Winter | 100 | +40% | 30/30 Winter | | | | 101.988 |
| 1.003 | CS1 | 60 Winter | 100 | +40% | 30/15 Winter | | | | 101.984 |
| 1.004 | S7 | 120 Winter | 100 | +40% | 30/15 Summer | | | | 102.064 |

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume (m³) | Flow / Cap. | Overflow (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|---|
| 1.000 | S1 | -0.096 | 0.000 | 0.28 | | | 4.6 | OK | |
| 1.001 | S2 | 0.009 | 0.000 | 0.14 | | | 2.2 | SURCHARGED | |
| 1.002 | S3 | 0.157 | 0.000 | 0.46 | | | 8.0 | SURCHARGED | |

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## 100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume (m³) | Flow / Cap. | Overflow (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|---|
| 2.000 | S4 | 0.059 | 0.000 | 0.35 | | | 5.8 | SURCHARGED | |
| 3.000 | S5 | 0.191 | 0.000 | 1.49 | | | 16.8 | FLOOD RISK | |
| 3.001 | S6 | 0.208 | 0.000 | 0.94 | | | 10.1 | SURCHARGED | |
| 1.003 | CS1 | 0.234 | 0.000 | 0.38 | | 64 | 5.3 | SURCHARGED | |
| 1.004 | S7 | 0.364 | 0.000 | 0.33 | | | 4.7 | FLOOD RISK | |

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