reside.

The Old Brickworks, Reeds Lane
Sayers Common

Flood Risk Assessment & Outline Surface Water Drainage Strategy

Reside Developments Ltd

The Old Brickworks, Sayers Common

Flood Risk Assessment & Outline Surface Water Drainage Strategy

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1 INTRODUCTION

RSK Land and Development Engineering Ltd (RSK) was commissioned to carry out a Flood Risk Assessment (FRA) for Reside Developments Ltd (the 'client'). The assessment is in support of the outline planning submission for the land at The Old Brickworks, Reed Lane, Sayers Common (the 'site').

The assessment has been prepared in accordance with the National Planning Policy Framework (NPPF)[1] and its accompanying Planning Practice Guidance[2], the Interim Code of Practice for Sustainable Drainage[3], BS 8533-2011 Assessing and Managing Flood Risk in Development Code of Practice[4] and the Non-statutory technical standards for sustainable drainage systems[5], with site-specific advice from the Environment Agency (EA), the Lead Local Flood Authority (LLFA), the Local Planning Authority (LPA), the architect and the client.

The NPPF sets out the criteria for development and flood risk by stating that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere.

The key definitions within the PPG are:

- "Flood risk" is a combination of the probability and the potential consequences of flooding from all sources – including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.
- "Areas at risk of flooding" means areas at risk from all sources of flooding. For fluvial (river) and sea flooding, this is principally land within Flood Zones 2 and 3. It can also include an area within Flood Zone 1 which the Environment Agency has notified the local planning authority as having critical drainage problems.

For this site, the key aspects that require the assessment are:

- The Environment Agency's indicative flood zone map shows that the site is located within Flood Zone 1 (**Figure 1.1);**
- The site area is approximately 2.01Ha therefore surface water drainage must be considered, and sustainable drainage systems (SuDS) should be considered, where possible; and

The comments given in this report and opinions expressed are subject to RSK Group Service Constraints provided in **Appendix A**.

[1] Communities and Local Government, 'National Planning Policy Framework', 2012

[2] Communities and Local Government, 'Planning Practice Guidance - Flood Risk and Coastal Change, ID 7', March 2014 http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/

[3] DEFRA, 'Interim Code of Practice for Sustainable Drainage Systems' National SUDS Working Group, July 2004

[4] BSI, 'BS 8533-2011 Assessing and managing flood risk in development Code of practice', 2011

[5] DEFRA, 'Sustainable Drainage Systems - Non-statutory technical standards for sustainable drainage systems', March 2015

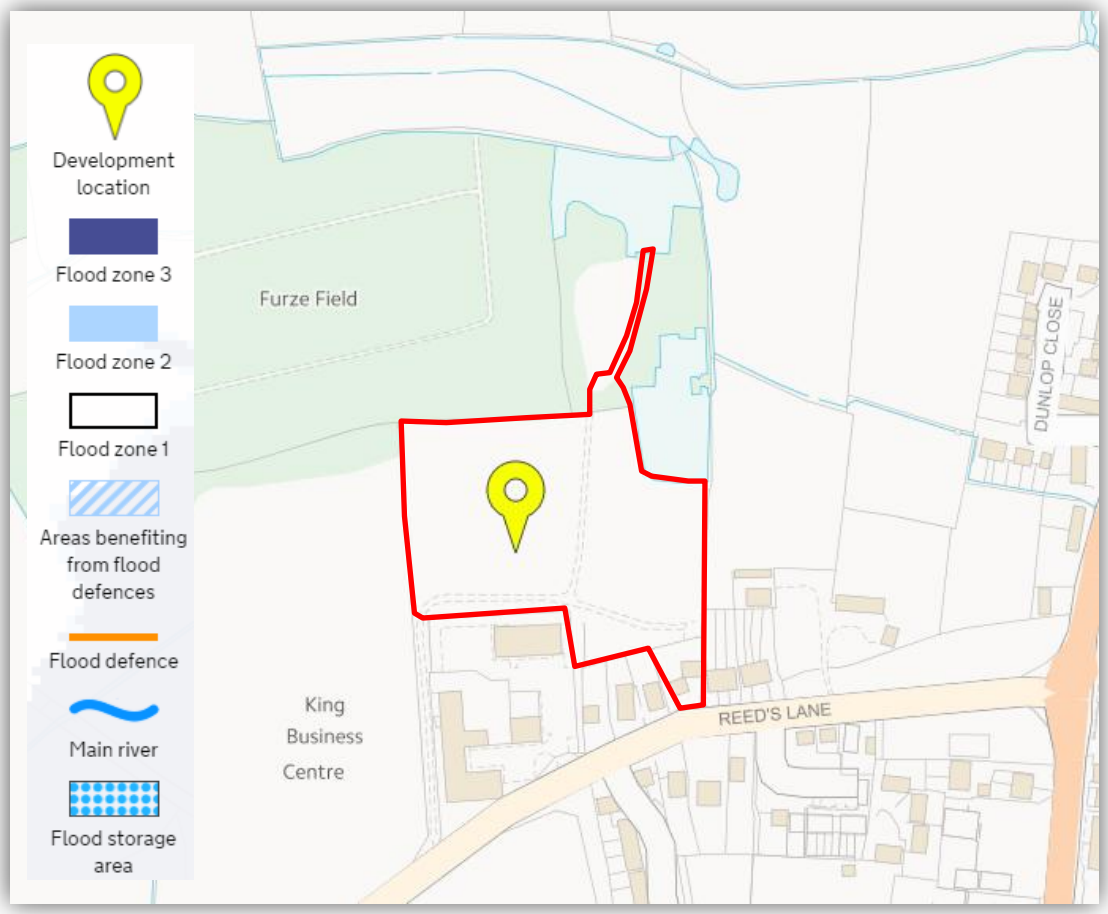

Figure 1.1: Environment Agency Flood Zone Map (accessed October 2017)

2 CONTEXT AND SCOPE OF WORK

A key element of project development is to prepare a FRA to establish the flood risk associated with the proposed development and to propose suitable mitigation, if required, to reduce the risk to a more acceptable level.

The scope of work relating to a FRA is based on the guidance provided in Section 10 of the NPPF and its accompanying Planning Practice Guidance.

A site-specific FRA must demonstrate that 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. The scope of this assessment therefore comprises the following elements:

- To review architect plans, planning information and other studies to determine existing site conditions;
- To obtain information on the hydrology and hydrological regime in and around the site;
- To obtain the views of the Environment Agency including scope, location and impacts;
- To obtain the views of the Lead Local Flood Authority including scope, location and impacts;
- To determine the extent of new flooding provision and the influence on the site;
- To assess the impact on the site from climate change effects and anticipated increases in rainfall over a 100 year period for residential uses;
- To review site surface water drainage based on the proposed layout and, if necessary, to determine the extent of infrastructure required; and
- To prepare a report including calculations and summaries of the source information and elements reviewed.

Reliance has been placed on factual and anecdotal data obtained from the sources identified. RSK cannot be held responsible for the scope of work, or any omissions, misrepresentation, errors or inaccuracies with the supplied information. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.

3 SITE DESCRIPTION

3.1 Location

Site Name: The Old Brickworks, Sayers Common

Site Address: The Old Brickworks,

Reeds Lane,

Sayers Common,

West Sussex,

BN6 9LS.

Site National Grid Reference: 526455 E, 118220 N

The existing site is located on Reeds Lane, set behind several private residential properties from which access to the site can be found. The site measures approximately 2.01Ha in total consists of an existing residential property in the south and a large area of roughly vegetated land. The site is located on the western extent of Sayers Common, a village, approximately 14km north of Brighton.

Table 3.1, below, provides a description of the immediate surroundings of the site.

Table 3.1: Site setting

Direction	Characteristic
North	Beyond the north west boundary of the site is vegetated with dense plant growth, this area is named Furze Field according to Ordnance Survey data. There is a ditch on site on the most northern boundary adjacent to the most northern pond. The pond is connected to the watercourse in the flowing east to west via a series of ditches.
East	The south eastern boundary of the site is formed by a 5m high hedge with mature oaks and willow trees. The boundary is described as having a drainage ditch that is silted and in poor condition; the ditch is fed from highway drainage of Reeds Lane. The north eastern boundary falls towards the pond that exists on the boundary.
South	The southern boundary line is against Kings Business Centre and includes the Lyndon residential property to provide site access from Reeds Lane. Mature trees form a boundary between the business park and the site. The land generally falls from the southern boundary towards the north.
West	A large Greenfield site is adjacent to the western boundary. The site partially falls towards the north western boundary.

Figure 3.1 shows a Site Location.

Figure 3.1: Site location

3.2 Land use and topography

A topographic survey has been provided for the site by Sunshine Survey Ltd (**Appendix B**). Generally the site falls from south to north.

The highest elevation on site is located at approximately 17.30m above ordnance datum (mAOD) at the southern boundary of the site by the business park. The area of high elevation extends northwards through the centre of the site. The land falls to either side of this, in a north east direction and in a north west direction.

The land that falls north west reaches a low point at the north west boundary at approximately 15.80mAOD. There are small, shallow ditches identified along this boundary with invert levels of 15.60mAOD conveying flow north.

Land that falls north east reaches the pond where there is a steep embankment from 15.50mAOD to the pond water level of 14.98mAOD.

A ditch was identified on the eastern boundary which conveys surface runoff from Reeds Lane and the Lyndon property, northwards past the eastern pond. The southern extent of this ditch is thought to be on the boundary, whilst the remaining length of the ditch is on the adjacent site. Field notes can be found in **Appendix C**.

A footpath crosses the centre of the site from south to north. A footpath also runs generally parallel to the southern boundary.

The approximate land use of the site is as follows:

Table 3.2: Existing site land uses

Land use	Area (m^2)	Percentage
Impermeable	175	<1
Permeable	19918	>99
Total	20093	100

Much of the impermeable area is made from paving and sheds, as rain water will drain to the surrounding ground from these areas the whole site can be considered as Greenfield.

3.3 Hydrology

The nearest designated Main River watercourse to the site is located approximately 2.4km to the North and is a tributary of the River Adur which flows from the east to the west. This is the ultimate destination of the ordinary watercourse located adjacent to the north of the site.

The nearest ordinary watercourse, which flows along the northern site boundary from east to west, is made from a series of ditches conveying surface water from the residential areas of Sayers Common. The ditches, to the east, conveys flow towards the north eastern boundary of the site; there is interaction between the ditches and the pond at the northern boundary on site as a ditch feeding into the pond and a ditch flowing westwards as an outfall. The pond on the eastern boundary is not thought to interact with this watercourse which is elevated above the eastern boundary.

Downstream of the outfall for the northern pond, the ditch conveys water in a westwards direction where the ditch widens into a channel over agricultural fields, towards the River Adur. Ponds and ditches described are identifiable in **Figure 1.1**.

3.4 Geology

Based on published geological records for the area (British Geological Survey online mapping), the site exhibits the following geology:

- Superficial Geology: According to BGS online mapping the site does not have superficial geology.
- Bedrock Geology: Weald Clay Formation - Dark grey thinly-bedded mudstones (shales) and mudstones with subordinate siltstones, fine- to medium-grained sandstones, including calcareous sandstone (e.g. Horsham Stone Member), shelly limestones (the so called "Paludina Limestones") and clay ironstones.

There were no nearby borehole records within the area on the British Geological Survey library available for analysis.

3.5 Hydrogeology

Hydrogeological information was obtained from the Environment Agency's online mapping service. These maps indicate the site is not located within a Groundwater Source Protection Zone and is a significant distance from the nearest Zone. The site is neither underlain with Superficial or Bedrock Aquifers.

The close proximity of the site to various watercourses and pond may suggest that shallow Groundwater may be present beneath the site. Further evidence of shallow Groundwater is provided by the Flood Incident report from 1997 **(Appendix D**) which noted anecdotal evidence from the residents of Lyndon on Reeds Lane. It was noted that a well in the garden had a water surface level approximately 18 inches (457mm) below the ground surface even during dry weather. Other evidence included heavily saturated lawns during rainfall events and a pond that was spring fed, south of Reeds Lane. Saturated ground may be due to impermeable top soils causing surface water to pond, as such a site investigation into Groundwater levels is advised to establish Groundwater levels.

4 DEVELOPMENT PROPOSALS

The proposed development is for a residential end use. The development will contain a variety of dwellings, driveways, gardens, access highways, areas of public open space and associated soft landscaping (**Appendix E**); a doctors surgery with parking will also be included at the access road to the site. Of this development area an impermeable area has been calculated by finding the total area covered by roads, buildings and parking spaces proposed in the site layout. Therefore the approximate land uses of the proposed site are summarised in **Table 4.1** below.

Table 4.1: Proposed site land uses

Land use	Area (m^2)	Percentage of Total Site (%)
Impermeable	7146	35.6
Permeable	12947	64.4
Total Site Area	20093	100

5 LEGISLATION AND POLICY CONTEXT

5.1 National policy

Table 5.1: National legislation and policy context

Legislation	Key provisions
National Planning Policy Framework (2012)	The aims of planning policy on development and flood risk are to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk. Where new development is, exceptionally, necessary in such areas, policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall.
Planning Practice Guidance (2014)	The NPPF is supported by an online Planning Practice Guidance, which provide additional guidance on flood risk.
Flood and Water Management Act 2010	The Flood and Water Management Act (FWMA) aims to implement the findings of the 2007 Pitt Review and co-ordinate control of drainage and flood issues. There are a number of increased responsibilities within the Act that affect adoption of SuDS features and the role of the Environment Agency to expand on the mapping data they provide. The implementation of SuDS features has many beneficial impacts on the treatment of surface water during remediation works.
Water Resources Act 1991	Section 24 – The Environment Agency is empowered under this Act to maintain and improve the quality of 'controlled' waters Section 85 – It is an offence to cause or knowingly permit pollution of controlled waters Section 88 – Discharge consents are required for discharges to controlled waters
Water Framework Directive (2000)	The Water Framework Directive (WFD) requires all inland and coastal waters to reach 'good' chemical and biological status by 2015. Flood risk management is unlikely to have a significant impact on chemical water quality except where maintenance works disturb sediment (such as de-silting) or where pollutants are mobilised from contaminated land by floodwaters. The main impact of the WFD on flood risk management, both now and in the future, relates to the ecological quality of water bodies. Channel works, such as straightening and deepening, or flood risk management schemes that modify geomorphological processes can change river morphology. The WFD aims to protect conservation sites identified by the EC Habitats Directive and Birds Directive that have water-related features, by designating them as 'protected sites'.

5.2 Local policy

Local policies ensures that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding and making development safe without increasing flood risk elsewhere and where possible, reducing flood risk.

Table 5.2: Local policy context

LDF document	Key provisions and policies
Mid Sussex District Plan 2014 – 2031 August 2016 – Submission Version	<u>DP41: Flood Risk and Drainage</u> Proposals for development will need to follow a sequential risk-based approach to ensure development is safe across its lifetime and not increase the risk of flooding elsewhere. The District Council's Strategic Flood Risk Assessment (SFRA) should be used to identify areas at present and future flood risk from a range of sources including fluvial (rivers and streams), surface water (pluvial), groundwater, infrastructure and reservoirs. SuDS should be implemented in all new developments of 10 dwellings or more. They should be appropriately used to avoid any increase flood risk and protect ground water quality. SuDS should be sensitively designed to enhance the landscape. The preferred hierarchy of managing surface water drainage from any development is: 1. Infiltration 2. Attenuation and discharge to watercourses 3. Discharge to surface water only sewers

6 SOURCES OF INFORMATION

6.1 Environment Agency consultation

6.1.1 Flood zone maps

The Environment Agency Flood Zone mapping study for England and Wales is available on their website at https://flood-map-for-planning.service.gov.uk/

The current displayed map is reproduced as **Figure 1.1** and shows the site to lie within Flood Zone 1 showing the site with low risk of fluvial or tidal sources.

Recently, the Environment Agency released an additional form of mapping 'Risk of Flooding from Rivers and Sea', which is available at:

https://flood-warning-information.service.gov.uk/long-term-flood-risk/

This map has been reproduced as **Figure 7.1** and shows the Environment Agency's assessment of the likelihood of flooding from rivers and the sea at any location and is based on the presence and effect of all flood defences, predicted flood levels, and ground levels.

The relevant guidance note from the Environment Agency is available online through the following link: https://www.gov.uk/planning-applications-assessing-flood-risk

6.1.2 Site specific consultation

The Environment Agency was formally consulted as part of this assessment, with request for flood related information (including flood levels) included in the consultation. Their full response to both the pre-planning enquiry and the flood data request can be found in **Appendix F**.

The information request confirms the following points:

- The site is located within Flood Zone 1;
- No modelled levels are available for the site, and;
- There is no historic flood mapping for the area.

6.2 Mid Sussex District Council

Mid Sussex District Council was contacted as part of RSK's initial enquiry. Information was also provided to RSK from the client following a pre application meeting between the client and Mid Sussex District Council (**Appendix G**).

Notes from the council conclude the following:

- The SuDS hierarchy must be followed for the disposal of surface water.
- People and property on site should be protected from flood risk, equally the development should not exacerbate flood risk to others beyond the site boundary

- A sustainable approach to drainage design must be considered to manage surface water at the source and the surface, this includes considering the ability to remove pollutants and improving water quality.
- Discharge to the watercourse should be restricted to Greenfield rates or Qbar run-off (dependent upon which is better). Any excess run-off will need to be attenuated for the 1 in 100 year storm event plus 40% climate change.
- Following phone conversation with the council it was concluded that discharge to the pond on the eastern boundary is unlikely to be appropriate. This is due to an outfall unlikely to exist for the pond, furthermore constructing an outfall into ditches east of the boundary may exacerbate current surface water flooding issues east of the site.

6.3 West Sussex County Council

West Sussex County Council has provided a response to RSK's initial contact. They advised flood and drainage enquiries should be directed to Mid Sussex District Council.

6.4 Internal Drainage Board

There are no known Internal Drainage Boards within the study area.

6.5 Canal & River Trust

There are no known Canal & River Trust maintained assets within the study area.

6.6 Relevant studies

Table 6.1: Relevant studies

Study	Comments
SFRA: Mid Sussex District Council June 2015	The principle aim of the SFRA was to map all forms of flood risk in order to provide an evidence base to locate new development. It also aims to provide appropriate policies for the management of flood risk, and identify the level of detail required for site-specific FRAs. The SFRA contains information and maps detailing flood sources and risks. West Sussex council identified Sayers Common as a 'wet spot', meaning it was identified as having a majority of properties at risk from surface water flooding. Sayers Common, however, was identified as being in an area of low potential for Groundwater flooding, whilst the majority of West Sussex is within an area of medium level potential for Groundwater flooding. Several historic records of flooding exist for in and around Sayers Common predominately due to poor surface water drainage systems. Is it identified that because of a predominately clay geology in the area that infiltration based SuDS will be minimal and that attenuation based SuDS will often be the most appropriate SuDS feature.
PFRA: West Sussex County Council May 2011	Preliminary Flood Risk Assessments are produced by Lead Local Flood Authorities (LLFAs) in England and Wales. A Preliminary Flood Risk Assessment (PFRA) is the first part of the planning cycle for flood risk management as set out in the Flood Risk Regulations (2009), which implement the requirements of the European (EU) Floods Directive (2007). The EU Floods Directive aims to provide a consistent approach to managing flooding across Europe. The PFRA considers local sources of flooding that the LLFA is responsible for: ordinary watercourses, surface water, groundwater and sewers where flooding is wholly or partially caused by rainwater or other precipitation entering or affecting the system. Information is gathered from existing sources on past floods and flood models to identify Flood Risk Areas. Key projections for the South East River Basin District, close to Sayers Common, concluded the following: • Winter precipitation increases of 18% are expected by 2018; • Peak river flows in a typical catchment is likely to increase between 11 and 24%.
CFMP: River Adur Catchment Flood Management Plan December 2009	Catchment Flood Management Plans (CFMP) give an overview of the flood risk from inland sources across each river catchment and recommend ways of managing those risks now and over the next 50-100 years. The Environment Agency is responsible for producing CFMPs. The site falls within the 'Adur South Downs (East)' sub-catchment and the policy applicable to this site is Policy Option 6 which states The Environment Agency "will take action with others to store water or manage run-off in locations that provide overall flood risk

Study	Comments
	reduction or environmental benefit.”. There is an intended focus here on sustainable design of the urban environment, in particularly focusing on redevelopments rather than existing developments. The CFMP provides the following key proposed actions: Ensure recommendations from SFRAs and LDFs create potential to reduce flood risk through. Adopt strategic approach explore the use of agri-environmental and woodland schemes to help fund land use management to increase water retention in the catchment. Encourage farmers to adopt better land use management in the catchment to reduce flood risk.

6.7 Drainage

6.7.1 Public sewer

Sewer records were not obtained for the purpose of this report. Known details of the sewer from the flood incident report (1997) (**Appendix D)** are:

- Foul network: A system flows from the west towards the east along Reeds Lane. The foul sewers flooded in the 1990’s as a result of surface water entering the system.
- Surface water network: Surface water runoff is piped under an outbuilding next door to the Lydon residential property northwards; the outfall for this pipe is on the site boundary at the rear of the private gardens of the properties. A ditch conveys the flow northwards but this ditch is poorly maintained with some runoff described as falling west onto the site.

6.7.2 Private drainage

No details of the existing on-site drainage were provided. It is thought that surface water runoff from the Lyndon residential property is directed onto the land behind the property. Field notes (**Appendix C**) show that there is a pipe outlet into a short swale which discharges into the eastern pond. It is not known where the source of the pipe is. One possible source may be that the pipe serves as private drainage for surface water runoff from the Kings Business Centre development. The topographic survey shows a 100mm diameter pipe outfall from this site in the direction of the pond, however the full length of the pipe was not identified. It is advised these two pipes are investigated further.

7 SOURCES OF FLOOD RISK

7.1 Criteria

In accordance with the NPPF and advice from the Environment Agency, a prediction of the flood sources and levels is required along with the effects of climate change from the present for the design life of the development (in this case assumed to be 100 years). To consider these effects of climate change, standard industry guidance recommends consideration of a 20% increase in rainfall intensity (with a recommendation for 40% by the Council) and 25% increase in peak river flows over this timeframe for a 'More Vulnerable' development in Flood Zone 1 (Central category).

The flood risk elements that need to be considered for any site are defined in BS 8533 as the "Forms of Flooding" and are listed as:

- Flooding from Rivers (fluvial flood risk);
- Flooding from the Sea (tidal flood risk);
- Flooding from the Land;
- Flooding from Groundwater;
- Flooding from Sewers (sewer and drain exceedance, pumping station failure etc); and
- Flooding from Reservoirs, Canals and other Artificial Structures.

The following section reviews each of these in respect of the subject site.

7.2 Flooding from rivers (fluvial flood risk)

7.2.1 Main River

The latest Environment Agency published flood zone map (**Figure 1.1**) shows that the site lies within Flood Zone 1, representing a 1 in 100 year or greater probability of flooding from fluvial sources or a 1 in 200 year probability of flood from tidal sources. It also shows that the site is located outside the influence of a Main River.

7.2.2 Ordinary Watercourse

The latest 'Risk of Flooding from Rivers and Sea' flood map (**Figure 7.1**) indicates that the site is considered to be at 'very low' risk of fluvial flooding. It should be considered that the ditch that serves the highway drainage from Reeds Lane along the eastern boundary poses some risk to the south east of the site. The ditch should be investigated further to assess the risk to the site.

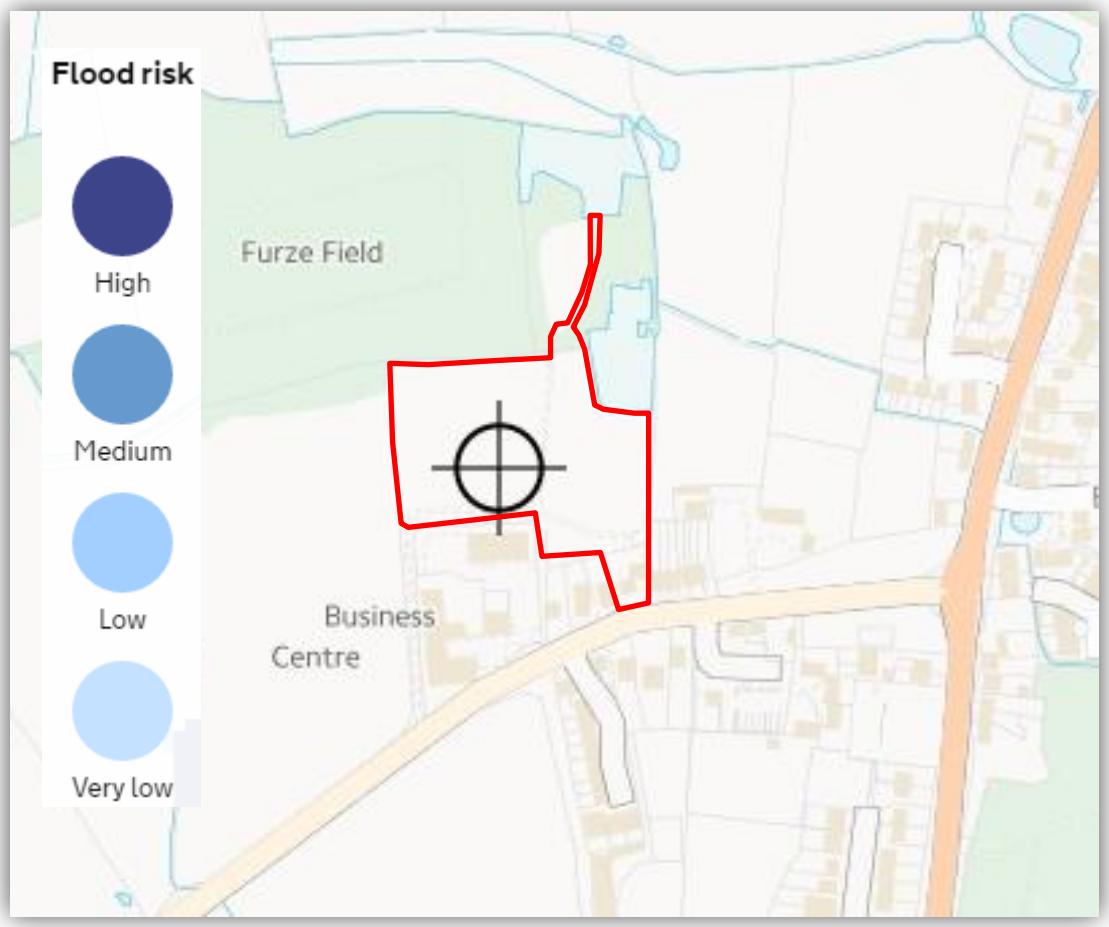

Figure 7.1: Environment Agency fluvial flood risk map

7.2.3 Climate change

Fluvial flooding is likely to increase as a result of climate change. A greater intensity and frequency of precipitation is likely to raise river levels and increase the likelihood of a river overtopping its banks.

7.3 Flooding from the sea (tidal flood risk)

The site is not considered to be at risk from tidal flooding due to its inland location.

7.4 Flooding from the land (overland pluvial flood risk)

If intense rain is unable to soak into the ground or be carried through manmade drainage systems, for a variety of reasons, it can run off over the surface causing localised floods before reaching a river or other watercourse.

Generally, where there is impermeable surfacing or where the ground infiltration capacity is exceeded, surface water runoff will occur. Excess surface water flows from

the site are believed to drain naturally to the local water features, either by overland flow or through infiltration.

The Environment Agency's surface water flood map (**Figure 7.2**) shows that the majority of the site is considered at very low risk from this source; however there are localised areas which are at risk:

- The north east and north of the site, at the eastern and northern ponds, are at high risk of pluvial flooding; however this does not extend far beyond the extent of the pond. This is likely due to the steep embankment on the site boundary. These risk areas do not extend into the developable area.
- There are low risk areas along the boundary with Furze Field; this will be due to the area at the boundary being of low elevation and surface water flowing to this low point.
- Within the site boundary there are areas of low and medium risk along the eastern boundary. This follows the path of the ditch that was identified as providing surface water drainage for Reeds Lane.

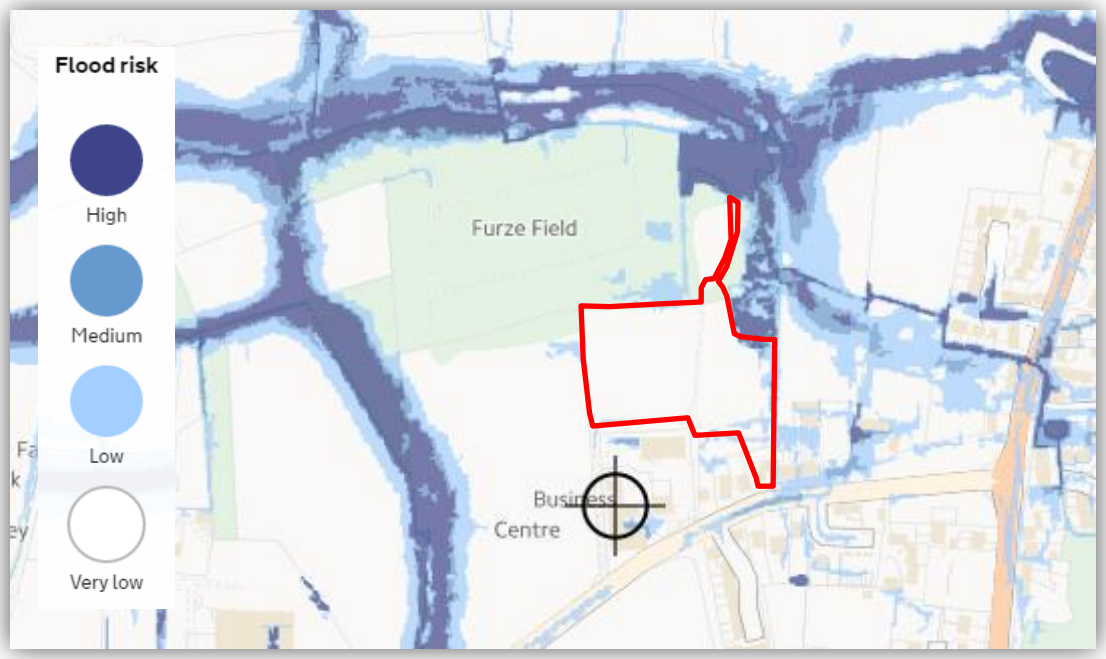

Figure 7.2: Environment Agency surface water flood risk map

7.4.1 Climate change

Surface water flooding is likely to increase as a result of climate change in a similar ratio to fluvial flooding. Increased intensity and frequency of precipitation is likely to lead to reduced infiltration and increased overland flow.

7.5 Flooding from groundwater

Groundwater flooding tends to occur after much longer periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels. Groundwater tends to flow from areas where

the ground level is high, to areas where the ground level is low. In low-lying areas the water table is usually at shallower depths anyway, but during very wet periods, with all the additional groundwater flowing towards these areas, the water table can rise up to the surface causing groundwater flooding.

A nearby borehole log located to the east of the proposed site indicates Groundwater was recorded at a depth of 4.00mbgl. However as discussed in **Section 3.5** there is anecdotal evidence of Groundwater at approximately 450mm below the ground surface. Close proximity to surface water features would also suggest Groundwater levels are high.

It is considered likely that perched Groundwater may be encountered during the groundworks phase, and therefore could present a risk to the site at the construction stage. During the operational phase, the absence of basement features within the proposals minimises the potential hazards posed by groundwater flooding.

So long as the existing drainage regime is maintained then resultant Groundwater flood risk is considered to be **low**. Further investigation should be undertaken to identify and observe the depth of Groundwater.

7.5.1 Climate change

Climate change could increase the risk of groundwater flooding as a result of increased precipitation filtering into the groundwater body. If winter rainfall becomes more frequent and heavier, groundwater levels may increase. Higher winter recharge may however be balanced by lower recharge during the predicted hotter and drier summers. This is less likely to cause a significant change to flood risk than from other sources, since groundwater flow is not as confined. It is probable that any locally perched aquifers may be more affected, but these are likely to be isolated. The change in flood risk is likely to be low.

7.6 Flooding from sewers

Flooding from artificial drainage systems occurs when flow entering a system, such as an urban storm water drainage system, exceeds its conveyance capacity, the system becomes blocked or it cannot discharge due to a high water level in the receiving watercourse. A sewer flood is often caused by surface water drains discharging into the combined sewer systems; sewer capacity is exceeded in large rainfall events causing the backing up of floodwaters within properties or discharging through manholes.

Most adopted surface water drainage networks are designed to the criteria set out in Sewers for Adoption[6]. One of the design parameters is that sewer systems be designed such that no flooding of any part of the site occurs in a 1 in 30 year rainfall event. By definition a 1 in 100 year event would exceed the capacity of the surrounding sewer network as well as any proposed drainage.

When exceeded, the surcharged pipe work will lead to flooding from backed up manholes and gully connections. This will lead to flooding within the surrounding area. Development has the potential to cause an increase in impermeable area, an associated increase in surface water runoff rates and volumes, and a consequent

[6] WRC, 'Sewers for Adoption' 7th Edition, 2012

potential increase in downstream flood risk due to overloading of sewers, watercourses, culverts and other drainage infrastructure.

The flood incident report from 1997 concluded surface water runoff from Reeds Lane is known to enter the foul sewer system, reducing capacity and causing surcharging further along the network in Sayers Common. The available capacities of these sewers are not currently known.

As not to exacerbate the sewer system with surface water runoff from the proposed development the SuDS strategy will take into consideration that surface runoff cannot be conveyed towards Reeds Lane. This ensures that any additional surface water and overland flows are managed correctly, to minimise flood risk to the site and the surrounding area. The proposed surface water network on the site should be designed to ensure exceedance of the network has been considered.

7.6.1 Climate change

The impact of climate change is likely to be negative regarding flooding from sewers. Increased rainfall and more frequent flooding put existing sewer and drainage systems under additional pressure resulting in the potential for more frequent surcharging and potential flooding. This would increase the frequency of local sewer flooding but not significant in terms of the proposed development.

7.7 Other sources of flooding

7.7.1 Reservoirs

Flood events can occur from a sudden release of large volumes of water from reservoirs, canals and artificial structures.

The Environment Agency reservoir flood map (reproduced as **Figure 7.4**) shows the largest area that might be flooded if a reservoir were to fail and release the water it holds. Since this is a prediction of a worst-case scenario, it is unlikely that any actual flood would be this large.

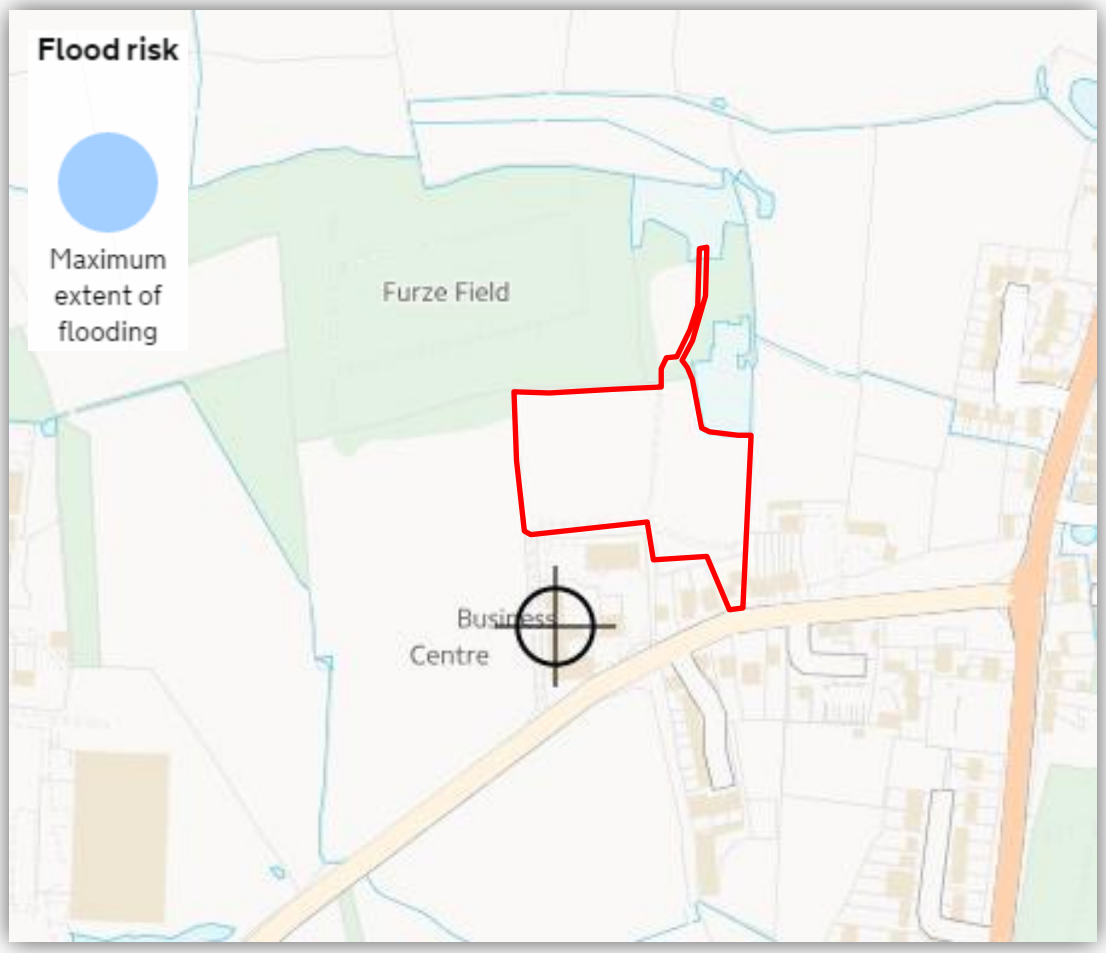

Figure 7.4: Environment Agency reservoir flood risk map

Reservoir flooding is also extremely unlikely. There has been no loss of life in the UK from reservoir flooding since 1925. Since then reservoir safety legislation has been introduced to ensure reservoirs are maintained. According to the Environment Agency Reservoir flood maps the site is not at risk of flooding from reservoirs.

The resultant flood risk is considered to be **low**.

7.7.2 Climate change

Reservoirs can be managed over time, controlling inflow/outflow of water and therefore there is the capacity to control the effects of climate change. Increased rainfall has the potential to increase base flow, but this should be minimal. It is unlikely that there will be a substantial change to the risk of flooding for this site.

7.7.3 Canals

There are no Canal & River Trust owned canals or assets within the study area.

7.8 Flood risk resulting from the development

In theory any development can increase flood risk downstream, if it is not designed properly. This potential is much increased where the site is on Greenfield land, as development tends to increase impermeable surfaces, resulting in increased runoff from the site.

The proposed development will use the best practice guidance to ensure that flood risk is not increased as a result of the development. This will require the provision of a suitable surface water management plan to ensure that the surface water generated from the site does not exceed the pre-development rates; this is investigated further in Section 9 of this report.

8 PLANNING CONTEXT

8.1 Application of planning policy

Section 10 of the NPPF includes measures specifically dealing with development planning and flood risk using a sequential characterisation of risk based on planning zones and the Environment Agency Flood Map. The main study requirement is to identify the flood zones and vulnerability classification relevant to the proposed development, based on an assessment of current and future conditions.

8.2 Land use vulnerability

Planning Practice Guidance includes a list of appropriate land uses in each flood zone dependent on vulnerability to flooding. In applying the Sequential Test, reference is made to **Table 8.1** below, reproduced from **Table 3** of Planning Practice Guidance.

Table 8.1: Flood risk vulnerability and flood zone 'compatibility'

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	Appropriate	Appropriate	Appropriate	**Appropriate**	Appropriate
	Zone 2	Appropriate	Appropriate	Exception Test Required	Appropriate	Appropriate
	Zone 3a	Exception Test Required	Appropriate	Should not be permitted	Exception Test Required	Appropriate
	Zone 3b functional floodplain	Exception Test Required	Appropriate	Should not be permitted	Should not be permitted	Should not be permitted

With reference to **Table 2** of the Planning Practice Guidance, the proposed development, based on its residential end use and 'Non residential uses for health services', is classed as 'More Vulnerable'. This classification of development is appropriate for areas within Flood Zone 1 and therefore appropriate for the subject site.

8.3 Sequential Test

The Sequential Test is required to assess flood risk and the Planning Practice Guidance recommends that the test be applied at all stages of the planning process to direct new development to areas with the lowest probability of flooding (Flood Zone 1).

According to the NPPF, if there is no reasonably available site in Flood Zone 1, the flood vulnerability of the proposed development (see Planning Practice Guidance Table

2) can be taken into account in locating development in Flood Zone 2 and then Flood Zone 3. Within each Flood Zone new development should be directed to sites at the lowest probability of flooding from all sources.

The development proposal is for a 'More Vulnerable' residential use to be developed on the site. With reference to **Table 8.1** above, this development would be appropriate for areas within Flood Zone 1, subject to the implementation of an appropriate surface water drainage strategy. Therefore the proposed development passes the Sequential Test and does not require the Exception Test to be satisfied.

9 SURFACE WATER DRAINAGE ASSESSMENT

9.1 Scope

As development will be located in Flood Zone 1 and it is greater than 1ha in size, the Environment Agency and the Lead Local Flood Authority requires such development to focus on the management of surface water run-off. This section discusses the potential quantitative effects of the development on both the risk of surface water flooding on-site and elsewhere within the catchment, as well as the type of potential SuDS features that could be incorporated as part of the framework development plan.

The NPPF states that SuDS should be considered wherever practical. The use of SuDS is also encouraged by regional and local policy (see Section 5). In accordance with local and national guidance, the surface water drainage strategy should seek to implement a SuDS hierarchy that aspires to achieve reductions in surface water runoff rates to Greenfield rates (Preferred Standard).

In addition, Building Regulations Part H[7] requires that the first choice of surface water disposal should be to discharge to an adequate soakaway or infiltration system, where practicable. If this is not reasonably practicable then discharge should be to a watercourse, the least favourable option being to a sewer (surface water before combined). Infiltration techniques should therefore be applied wherever they are appropriate.

9.2 Pre-development situation

The existing site area is 2.01Ha and is considered 100% Greenfield. The Greenfield surface runoff rate has been calculated from the total proposed developable area, found to be 1.374Ha. The pro-rata IoH 124 (ICP SuDS) method[8] has been used using WinDes software to estimate the Greenfield surface water runoff for the total developable area on site.

Table 9.1: ICP SuDS surface water runoff (Greenfield, total developable area)

Return period	Peak flow (l/s)
QBar	7.1
1 in 1 year	6.0
1 in 30 year	16.0
1 in 100 year	22.5

[7] HM Government (2010 with 2013 amendments), 'The Building Regulations 2010: Approved Document H - Drainage and Waste Disposal (2002 Edition incorporating 2010 amendments)'

[8] Institute of Hydrology (IoH), 'Flood Estimation for small catchments - Report 124', 1994

9.3 Limiting discharge for design

The Greenfield discharge rates from the proposed developable area have been calculated and the results have been provided within **Table 9.1** and **Appendix H**. In order to not exacerbate the risk of flooding to both the development and others downstream of the site a complex control mechanism should be utilised to limit flows to the QBar as outlined within **Table 9.1** above at 7.1l/s.

This should be reflected within the detailed design of the site and should be agreed by the Lead Local Flood Authority.

9.4 Post-development situation

The proposed development is for a residential end use. As explained within Section 4 of this assessment, the current framework development plan shows a total developable area of 1.374Ha and a figure of approximately 0.715Ha of impermeable area of this developable area has been calculated from the proposed development plans. Increases in impermeable area will result in an increase in surface water runoff across the site. It will therefore be necessary to manage surface water on-site in order to limit the discharge of surface water off-site to an agreed rate (as above), to provide sufficient on-site attenuation up to the 1 in 100 year climate change rainfall event and to provide improvements to water quality through appropriate source treatment.

Additionally, 0.040Ha of road surface from Reeds Lane will be incorporated into the SuDS strategy. This acts to address surface water issues currently existing on Reeds Lane and may help towards resolving capacity issues with the highway sewers along Reeds Lane. The total impermeable area draining to the attenuation basin is therefore 0.755Ha.

9.4.1 Off site discharge options

9.4.1.1 Infiltration

Infiltration should be considered as the primary option to discharge surface water from the developed site. The effectiveness of infiltration is completely dependent on the physical conditions at the site. Potential obstacles include:

- Local variations in permeability preventing infiltration – It is understood from the local geology that the site is situated on an area predominantly underlain by Clay or Mudstone, which are not considered suitable for the use of soakaways due to its low permeability.
- Shallow Groundwater table - For infiltration drainage devices, Building Regulation approved document H2 states that these *"should not be built in ground where the water table reaches the bottom of the device at any time of the year"*. From accounts of saturated lawns and a well at the Lydon residential property then it is thought Groundwater will be shallow.
- Source Protection Zones - As discussed above, the site is not located within a Groundwater Source Protection Zone.

From the information available regarding the study area's underlying clay and mudstone based geology, infiltration is not considered a viable option as part of the drainage strategy.

9.4.1.2 Discharge to watercourse

Discharging surface water directly to a local watercourse is considered feasible as there is a ditch located within the most northern boundary connecting to the northern pond. The site drains naturally to the pond on the eastern boundary; however there is no confirmed outfall for this pond. There is also a ditch located on the south eastern boundary of the site; however, this is elevated above the proposed site and therefore does not provide a feasible discharge location.

9.4.1.3 Discharge to surface water sewer

From the current drainage situation it is assumed then that there is no surface water sewer available for connection or the existing sewer does not have the capacity to drain the existing runoff. Additionally the sewer would is unlikely to be deep enough to drain the northern extent of the development. If there is a surface water sewer then connecting to the sewer would not benefit the village as per the council's requirement for the development.

9.4.2 Storage estimates

To determine the volume of attenuation storage that would be required on the site, the WinDes ' 4-Stage Design Guide' tool has been used. The WinDes '4-Stage Design Guide' tool allows for an attenuation figure to be calculated based upon pond dimensions, rainfall values and permitted discharge rates. These volumes can be later revised at detail design stage by the introduction of specific flow control methods.

Calculations have been run using discharge rate in accordance with **Table 9.1**, above and a proposed impermeable area of 0.755Ha which includes the 0.040Ha of offsite road surface. No allowance is included in the calculations for infiltration and therefore the results illustrate a worst-case scenario.

The maximum storage required on-site to accommodate the 1 in 100 year plus 40% climate change rainfall event when limited to the QBar (7.1l/s) is approximately **474m^3**. Calculations can be found in **Appendix I**.

This volume is provided to demonstrate the feasibility of a proposed drainage strategy for the development; however, the final attenuation volume will be determined during subsequent detailed design work and should be agreed by the Lead Local Flood Authority.

9.4.3 Proposed drainage strategy

It is considered likely that infiltration techniques will not be suitable on-site due to the less permeable clay based soils, underlying geology and assumed Groundwater conditions. Soakaways or other infiltration based SuDS will not be incorporated into the drainage design as a result. Following on-site ground investigations, the site-specific ground conditions and infiltration rates, should be confirmed, if possible. This will confirm whether infiltration based SuDS will be able to be incorporated into the design.

Therefore the proposed SuDS for the site includes a network of surface water drainage pipes under the road network that convey surface water runoff from the whole developable area to an open attenuation basin located north east of the proposed

development. Surface water runoff is attenuated in the basin prior to discharge at a controlled rate to ditch leading northwards to the existing pond. The SuDS measures are outlined in the Indicative Surface Water Strategy as attached in **Appendix J**.

An attenuation basin has been strategically located within the area of open space to the north east of the site, adjacent to the pond. The topography in this area is suitable for SuDS features as this is the lowest topographic location on-site besides the pond. However the land in the south western extent of the site will need to be raised by approximately 1.5m with a suitable downwards gradient provided towards the basin in the north east. The final level of land raising should be confirmed at detailed design.

An attenuation volume of 474m^3 is justified in **Section 9.4.2**, further considerations at detailed design should include producing a basin that is shallow enough to provide a sufficient fall from the invert level of the basin to the existing pond (discharge location). Indicative cover levels and invert levels are given in the Indicative Surface Water Strategy (**Appendix J**). The basin should also be designed with slopes of 1:4 to comply with safety and maintenance guidelines as highlighted in the SuDS Manual[9]. Additionally the basin should be lined with an impermeable membrane so as not to allow Groundwater to compromise the capacity of the basin.

Permeable paving will be incorporated within private roads, shared surfaces and drive ways that are part of the development. These can be used to collect and store runoff from the houses and surrounding hardstanding areas before joining the on-site surface water network that flows into and basin and pond. Permeable paving reduces the volume of suspended sediment and hydrocarbon pollution associated with residential developments. Adopted roads will not be constructed using permeable paving due to ownership and future maintenance issues, where responsibility will most likely lie with the highway authority.

Water butts can reduce surface water runoff from the development; whilst these have not been calculations, they will be included in the final development. Green roofs are not part of proposal.

Other considerations include investigating the pipe outlet and swale at the eastern pond. The source of the pipe should be found and the flow should be incorporated into the surface water strategy, ideally the connection to the eastern pond should be maintained. The poorly maintained ditch behind the Lydon residential property on the eastern boundary should be repaired where possible within the site boundary to ensure there is no runoff from the ditch onto the site.

The dimensions, volumes and location of the SuDS features will need to be revised as the development framework plan develops and during the detailed planning stage. Indicative dimensions are provided as part of this report to provide an indication of the surface area that would be required for attenuation. Detailed design of individual features is not part of the scope of this report. Preliminary design criteria have been based upon guidance given in the CIRIA publication The SuDS Manual and the information received to date.

[9] CIRIA, 'The SUDS Manual - C697', 2007

10 FLOOD MITIGATION MEASURES

10.1 Overview

The site is currently proposed to be a residential end use development. As a result, is considered to be More Vulnerable. However, as the site is at low risk from all sources of flooding, it is not proposed that additional mitigation measures should be incorporated into the design. There are elements of best practice which should be considered at an early stage as outlined below.

10.2 Overland flood flow

Existing overland flood flow is predicted to flow to the north. As the Environment Agency's online mapping suggests there is a risk, albeit low, of surface water flow paths on Furze Field outside of the site boundary. Water is conveyed northwards to the pond and should not affect the proposed development.

10.3 Finished floor levels

As this site will not be affected by fluvial flooding there is no need to incorporate any freeboard levels into the finished floor levels of the design. Low lying areas that could lead to ponding of surface flows will be avoided by careful design of finished levels.

As a result it is recommended that the proposed site levels should be set at or above the existing ground levels from a flood risk aspect.

Where site levels are proposed to be elevated, in order to engineer a fall across the site for drainage purposes, all falls should be away from the properties whilst still tying in to the proposed highways.

10.4 Safe access/egress

As the site is lies outside of the 1 in 1000 year climate change flood extent, safe access and egress will be available up to this storm event. For extreme events above this, it is considered appropriate that site users should be able to safely escape to an area away from the watercourse. In addition, the proposed buildings will be set above the existing ground level and will likely contain an internal access to the first floor.

11 CONCLUSIONS AND RECOMMENDATIONS

This Flood Risk Assessment complies with the NPPF and Planning Practice Guidance and demonstrates that flood risk from all sources has been considered in the proposed development. It is also consistent with the Local Planning Authority requirements with regard to flood risk.

The proposed development site lies in an area designated by the Environment Agency as Flood Zone 1, and is outlined to have a chance of flooding of less than 1 in 1,000 (<0.1%) in any year.

NPPF sets out a Sequential Test, which states that preference should be given to development located within Flood Zone 1. This flood risk assessment demonstrates that the requirements of the Sequential Test have been met, with the location of the site within Flood Zone 1 means that any form of classification of development is considered to be acceptable.

This flood risk assessment has concluded that:

- There are no historic records of flooding within the site boundary, but there is historic surface water flooding along Reeds Lane;
- The location at which the proposed development is located within Flood Zone 1, and as such is at a very low risk of flooding from fluvial sources. The ditches and pond at the most northern area of the site do not pose a fluvial flood risk.
- The site is far enough inland not to be at risk of any tidal flooding event;
- Flood risk from surface water is considered very low across the majority of the site. There is a high risk of pluvial flooding at the most northern area of the site, but this is not near to the proposed developable area.
- Flood risk from Groundwater is considered to be low as there is no historic record of Groundwater emergence and flooding in the area. However based upon above ground observations, it is recommended that during site investigations the ground conditions and Groundwater depths are investigated;
- There are no on-site sewers; however an outlet can be found at the eastern pond suggesting water is conveyed across the site from an unknown source. This source will need to be investigated and the will need to be incorporated in the SuDS strategy once found.
- The site is not at risk from reservoir flooding;
- There are no Canal & River Trust assets within the study area and therefore the site is not at risk from this source.

As safe pedestrian and vehicular access, to and from the development, will be achievable under all conditions, a formal evacuation plan is not required.

Following the SuDS Hierarchy infiltration based drainage should first be assessed; however, based on BGS mapping and known ground conditions the underlying ground conditions will not likely support the use of infiltration. This should be confirmed on-site; however, an alternative has been sought as a result of these assumptions. Due to the

presence of the watercourse via a pond located on the northern site boundary, this is the proposed discharge location. As the fall from the site to the watercourse is relatively shallow, there will be a requirement to raise site levels in order to provide sufficient gravity falls from the proposed development into the attenuation basin and onwards into the watercourse. This should be confirmed at detailed design stage.

The proposed development will increase the impermeable surfacing on-site which will result in an increase of surface water runoff. As the whole site is considered to be Greenfield in terms of drainage, the proposed developable area should be limited to the pre-development Greenfield rate. As a result, the risk of flooding downstream will not be exacerbated. The resulting additional attenuation requirements has been demonstrated to be able to be stored on site prior to discharge into the watercourse on the north boundary. Attenuation is also provided to accommodate additional runoff from Reeds Lane that will be incorporated into the proposed onsite drainage strategy.

Overall, taking into account the above points, the development of the site should not be precluded on flood risk grounds as the development will not be at risk from existing sources (provided flow paths and sufficient attenuation is provided) will not result in an increase in flooding downstream.

APPENDIX A
SERVICE CONSTRAINTS

RSK Group service constraints

1. This report and the Drainage design carried out in connection with the report (together the "Services") were compiled and carried out by RSK LDE Ltd (RSK) for Reside Developments Ltd. (the "client") in accordance with the terms of a contract between RSK and the "client. The Services were performed by RSK with the skill and care ordinarily exercised by a reasonable Civil Engineer at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the client.

2. Other than that expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.

3. Unless otherwise agreed the Services were performed by RSK exclusively for the purposes of the client. RSK is not aware of any interest of or reliance by any party other than the client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. Any such party would be well advised to seek independent advice from a competent environmental consultant and/or lawyer.

4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date hereof, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.

5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.

6. The observations and conclusions described in this report are based solely upon the Services, which were provided pursuant to the agreement between the client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition,

the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off the site of asbestos, electromagnetic fields, lead paint, heavy metals, radon gas or other radioactive or hazardous materials.

7. The Services are based upon RSK's observations of existing physical conditions at the site gained from a walk-over survey of the site together with RSK's interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The Services are also based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely. The Services clearly are limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the walk-over survey. Further RSK was not authorised and did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services. RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the client and RSK.

8. The phase II or intrusive environmental site investigation aspects of the Services is a limited sampling of the site at pre-determined borehole and soil vapour locations based on the operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site. In addition chemical analysis was carried out for a limited number of parameters [as stipulated in the contract between the client and RSK] [based on an understanding of the available operational and historical information,] and it should not be inferred that other chemical species are not present.

9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan, but is (are) used to present the general relative locations of features on, and surrounding, the site.

APPENDIX B
TOPOGRAPHIC SURVEY

Sheet Location Diagram:

1.

LEGEND

Abbreviated Features

AV	Air Valve	FWP	Foul Water Down Pipe	SVP	Soil & Vent Pipe
ACP	Air Conditioning Plant	GP	Gate Post	SW	Surface Water
BB	Belishia Beacon	GV	Gas Valve	SWP	Surface Water Down Pipe
BD	Bollard	G	Gully	Tac.	Tactile Paving
BIG	Building Inlet Gully	HL	Head Level	Tar.	Tarmac
BL	Bed Level	IC	Inspection Cover	TB	Traffic Bollard
Blkp.	Block Paving	IL	Invert Level	TCB	Telephone Call Box
Blk.	Block	KO	Kerb Outlet	TC	Telecom Cover
BM	Bench Mark	LB	Letter Box	TCP	Telecom Pillar
BN	Bin	LG	Light	TF	Traffic Lights
BP	Boundary Peg	LH	Lamp Hole	THL	Thresh Hold Level
Brk.	Brick	LP	Lamp Post	TM	Ticket Machine
BS	Bus Stop	MH	Manhole	TP	Telephone Pole
CB	Cycle Barrier	MP	Marker Peg	UTL	Unable to Lift
CCTV	Close Circuit T.V	MS	Mile Stone	UG	Underground
CL	Cover Level	NB	Notice Board	VC	Valve Chamber
Col.	Column	NP	Name Plate	VT	Vent
Conc.	Concrete	OH	Over Head	VTG	Vent Grill
CTV	Cable TV Cover	PE	Pipe	VTP	Vent Pipe
CTP	Cable TV Pillar	PB	Post Box	WM	Water Meter
CP	Control Post	PM	Parking Meter	WN	Window
CV	Unidentified Cover	PWL	Parapet Wall Level	WT	Water Level
DP	Down Pipe	PT	Post	WO	Wash Out
DPC	Damp Proof Course	RE	Rodding Eye	Av.	Average
DC	Drainage Channel	RFL	Roof level	Ht.	Height
DK	Drop Kerb	RGL	Ridge	(A)	Authorities Information
EC	Electricity Cover	RP	Reflective Post	(BD)	Back Drop
ECP	Electricity Pillar	RS	Road Sign	(CEP)	Concrete Posts
EP	Electricity Pole	RWP	Rain Water Down Pipe	(H)	High Level
EPL	Electric Power Line	SA	Soakaway	(L)	Low Level
ER	Earth Rod	SEP	Service Entry Point	(LI)	Local Information
Est.	Estimated	SC	Stop Cock	(M)	Mid Level
EVL	Eaves Level	SCV	Service Cover	(MTP)	Metal Posts
FDP	Feeder Pillar	SFL	Soffit Level	(TMP)	Timber Posts
FH	Fire Hydrant	SL	Sill Level	(ac)	Assumed Connection
FL	Floor Level	SN	Sign	(uc)	Unknown Connection
FS	Flag Staff	SP	Service Pillar	(us)	Unknown Source
FW	Foul Water	SV	Stop Valve	Ø	Diameter(mm)

Symbols:

Service Cover : (Under 250mm)

Manhole/Inspection Chamber : Inlet, Inlet, Outlet

Control Station : A

Gates : Single, Double, Style

Wet/Marsh Land :

Bush/Shrub : Bush Sp:8.00 Ht:8.00

Tree : Beech Sp:8.00 Di:0.60 Ht:8.00

Tree (Multi-Bole) : Beech Sp:8.00 Di:0.60 Ht:8.00

Tree (Coppice) : Beech Sp:8.00 Di:0.60 Ht:8.00

Note: Tree heights are indicative

Line Types:

Embankment : Top of Bank, Bottom of Bank

Overhead Telecom Line :

Overhead Electricity Line :

Drop Kerb :

Contours : 1, 0.5

Hedge :

Root Line :

Foliage :

Tree Canopy :

Fence :

Change in Type/Height : Chg.

Hatching

Building:

Building/Shed:

Glass House :

Building Levels

Ridge Level, ROOF DETAIL, Eaves Level (Bottom of Tiles), Soffit Level

Note:
Buildings and trees surveyed outside the boundary of the site in adjacent properties have been measured remotely, information shown is indicative

Rev.	Date	Revisions

Notes:

The accuracy and detail shown in this drawing is dependant on the original specification. Sunshine Survey Ltd. should be consulted before use of scales other than those stated.

This drawing provides position and description of features on the ground at the time the survey was undertaken and in no way implies legal title or boundary ownership.

Where boundary alignment lines are added to the survey drawing and are taken from legal documents or other information supplied they are done so within the constraints of drawing uality and scale. They are provided on the basis of opinion and do not imply legal contract.

Detail re uired outside of site boundaries with no permission for access or public right of way will be surveyed by remote measurement where possible, the detail shown is indicative.This also applies to areas within the site with limited or no access due to dense undergrowth or unsafe areas.

All care has been taken in the preparation of this drawing any discrepancies found should be reported to Sunshine Survey Ltd. immediately.

Underground Services:

Where underground service information is shown, all care has been made to comply to the original specification. Although Sunshine Survey Ltd. has taken care in establishing the whereabouts of underground services the information shown on this plan is given without obligation, or warranty, the accuracy cannot be guaranteed. No liability of any kind is accepted by Sunshine Survey Ltd. or its agents for any error or omission.

All underground service information is gained from measurements within drainage/service chambers, connections and alignments of pipe/duct runs are indicative. Where appropriate local information will be annotated. Before use of any underground information the user should satisfy themselves of the completeness and accuracy before undertaking any works, safe digging practices should be used.

Plan Coordinate Control:
Plan co-ordinates relate to a local survey grid coincident with OS National Grid using OSTN15 transformation at Control Station H. Scale factor 1.00 applied.

Level Datum:
All levels relate to OS Newlyn datum using geoid model OSGM15 at Control Station H

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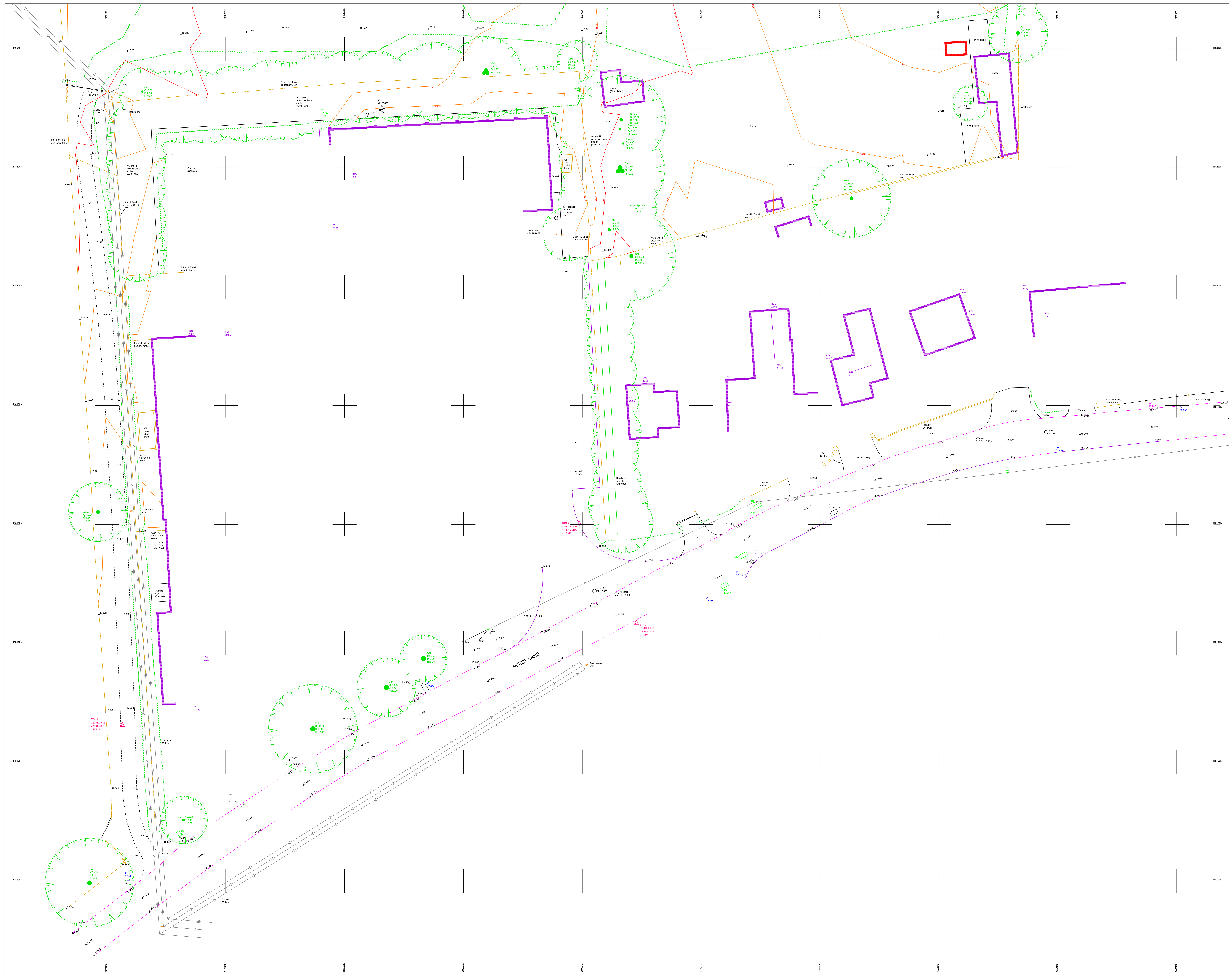
Project Title:
THE OLD BRICKWORKS REEDS LANE HASSOCKS

Client:
RESIDE DEVELOPMENTS LIMITED

Description:
TOPOGRAPHICAL SURVEY (Sheet 1 of 3)

Date	03-10-2017	Scale	1\200 @ A0
Job No.	GY\4594	Surveyor	GY
Drg No.	1\001	Drawn	GY



LEGEND

Abbreviated Features

AV	Air Valve	FWP	Foul Water Down Pipe	SVP	Soil & Vent Pipe
ACP	Air Conditioning Plant	GP	Gate Post	SW	Surface Water
BB	Belisha Beacon	GV	Gas Valve	SWP	Surface Water Down Pipe
BD	Bollard	G	Gully	Tac.	Tactile Paving
BIG	Building Inlet Gully	HL	Head Level	Tar.	Tarmac
BL	Bed Level	IC	Inspection Cover	TB	Traffic Bollard
Blkp.	Block Paving	IL	Invert Level	TCB	Telephone Call Box
Blk.	Block	KO	Kerb Outlet	TC	Telecom Cover
BM	Bench Mark	LB	Letter Box	TCP	Telecom Pillar
BN	Bin	LG	Light	TF	Traffic Lights
BP	Boundary Peg	LH	Lamp Hole	THL	Thresh Hold Level
Brk.	Brick	LP	Lamp Post	TM	Ticket Machine
BS	Bus Stop	MH	Manhole	TP	Telephone Pole
CB	Cycle Barrier	MP	Marker Peg	UTL	Unable to Lift
CCTV	Close Circuit T.V	MS	Mile Stone	UG	Underground
CL	Cover Level	NB	Notice Board	VC	Valve Chamber
Col.	Column	NP	Name Plate	VT	Vent
Conc.	Concrete	OH	Over Head	VTG	Vent Grill
CTV	Cable TV Cover	PE	Pipe	VTP	Vent Pipe
CTP	Cable TV Pillar	PB	Post Box	WM	Water Meter
CP	Control Post	PM	Parking Meter	WN	Window
CV	Unidentified Cover	PWL	Parapet Wall Level	WT	Water Level
DP	Down Pipe	PT	Post	WO	Wash Out
DPC	Damp Proof Course	RE	Rodding Eye	Av.	Average
DC	Drainage Channel	RFL	Roof level	Ht.	Height
DK	Drop Kerb	RGL	Ridge	(A)	Authorities Information
EC	Electricity Cover	RP	Reflective Post	(BD)	Back Drop
ECP	Electricity Pillar	RS	Road Sign	(CEP)	Concrete Posts
EP	Electricity Pole	RWP	Rain Water Down Pipe	(H)	High Level
EPL	Electric Power Line	SA	Soakaway	(L)	Low Level
ER	Earth Rod	SEP	Service Entry Point	(LI)	Local Information
Est.	Estimated	SC	Stop Cock	(M)	Mid Level
EVL	Eaves Level	SCV	Service Cover	(MTP)	Metal Posts
FDP	Feeder Pillar	SFL	Soffit Level	(TMP)	Timber Posts
FH	Fire Hydrant	SL	Sill Level	(ac)	Assumed Connection
FL	Floor Level	SN	Sign	(uc)	Unknown Connection
FS	Flag Staff	SP	Service Pillar	(us)	Unknown Source
FW	Foul Water	SV	Stop Valve	Ø	Diameter(mm)

Symbols:

Service Cover : (Under 250mm)
Manhole/Inspection Chamber : Inlet, Outlet
Control Station :
Gates : Single, Double, Style
Wet/Marsh Land :
Bush/Shrub : Bush Sp:8.00 Ht:8.00
Tree : Beech Sp:8.00 Di:0.60 Ht:8.00
Tree (Multi-Bole) : Beech Sp:8.00 Di:0.60 Ht:8.00
Tree (Coppice) : Beech Sp:8.00 Di:0.60 Ht:8.00
Note: Tree heights are indicative

Line Types:

Embankment : Top of Bank, Bottom of Bank
Overhead Telecom Line :
Overhead Electricity Line :
Drop Kerb :
Contours : 1, 0.5
Hedge :
Root Line :
Foliage
Tree Canopy :
Fence :
Change in Type/Height : Chg.

Hatching

Building:
Building/Shed:
Glass House :

Building Levels

Ridge Level
ROOF DETAIL
Eaves Level (Bottom of Tiles)
Soffit Level

Note:
Buildings and trees surveyed outside the boundary of the site in adjacent properties have been measured remotely, information shown is indicative

Rev.	Date	Revisions

Notes:

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Plan Coordinate Control:
Plan co-ordinates relate to a local survey grid coincident with OS National Grid using OSTN15 transformation at Control Station H. Scale factor 1.00 applied.

Level Datum:
All levels relate to OS Newlyn datum using geoid model OSGM15 at Control Station H

SUNSHINE SURVEY LTD.
LAND & MEASURED BUILDING SURVEYORS

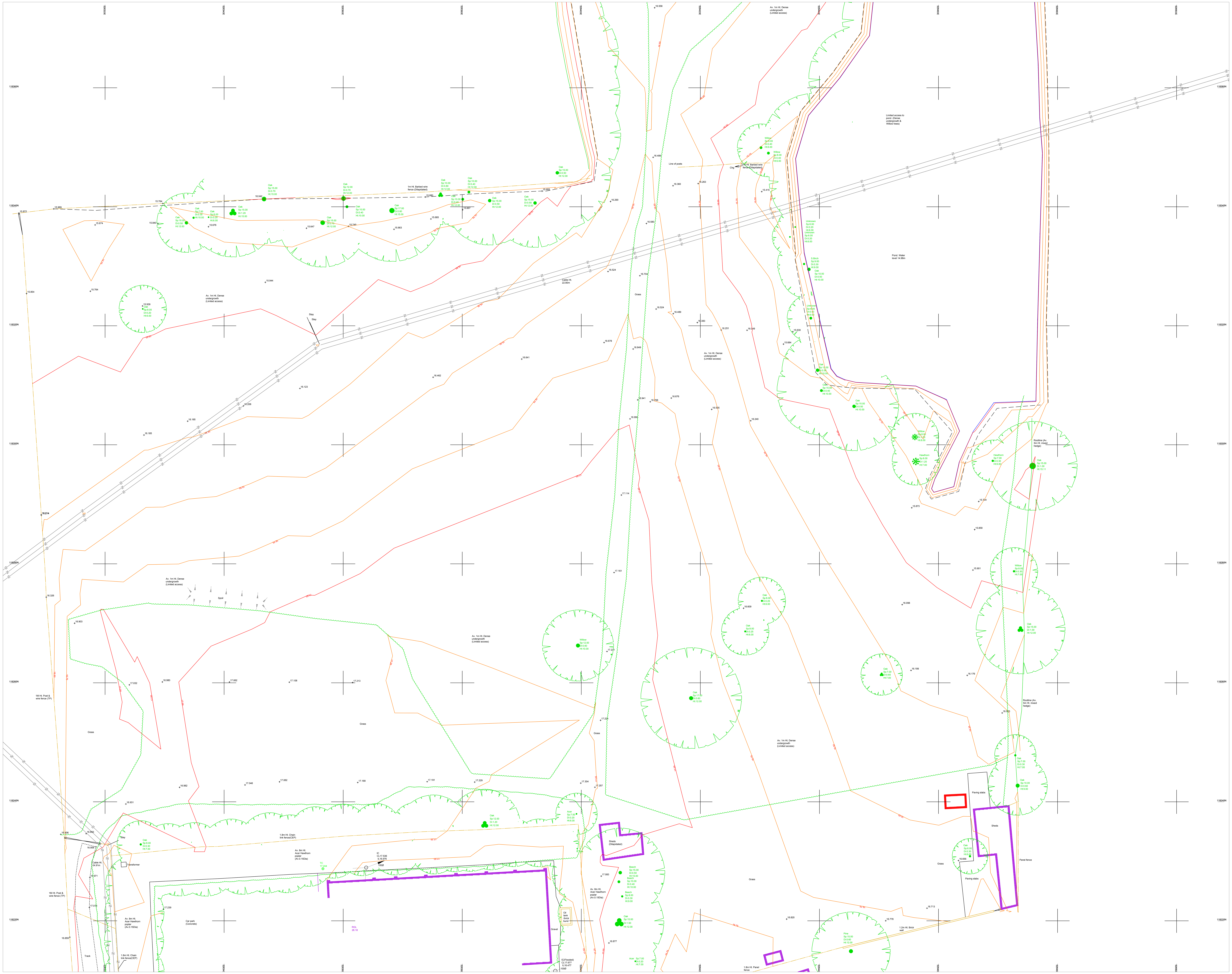
Business Reply Address:
28 Cadogan Road, Bury St. Edmunds, Suffolk, IP33 3□J
Tel: 01284 850255
Email: info@sunshinesurvey.co.uk
Web: www.sunshinesurvey.co.uk

Project Title:
THE OLD BRICKWORKS REEDS LANE HASSOCKS

Client:
RESIDE DEVELOPMENTS LIMITED

Description:
TOPOGRAPHICAL SURVEY (Sheet 3 of 3)

Date	03-10-2017	Scale	1\200 @ A0
Job No.	GY\4594	Surveyor	GY
Drg No.	1\001	Drawn	GY



Sheet Location Diagram:

2.

LEGEND

Abbreviated Features

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ACP	Air Conditioning Plant	GP	Gate Post	SW	Surface Water
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Building Levels

Ridge Level, ROOF DETAIL, Eaves Level (Bottom of Tiles), Soffit Level

Note: Buildings and trees surveyed outside the boundary of the site in adjacent properties have been measured remotely, information shown is indicative

Rev.	Date	Revisions

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Web: www.sunshinesurvey.co.uk

Project Title:
THE OLD BRICKWORKS REEDS LANE HASSOCKS

Client:
RESIDE DEVELOPMENTS LIMITED

Description:
TOPOGRAPHICAL SURVEY (Sheet 2 of 3)

Date	03-10-2017	Scale	1\200 @ A0
Job No.	GY\4594	Surveyor	GY
Drg No.	1\001	Drawn	GY

APPENDIX C
FIELD NOTES

Title:
Comment:

MID SUSSEX DISTRICT COUNCIL

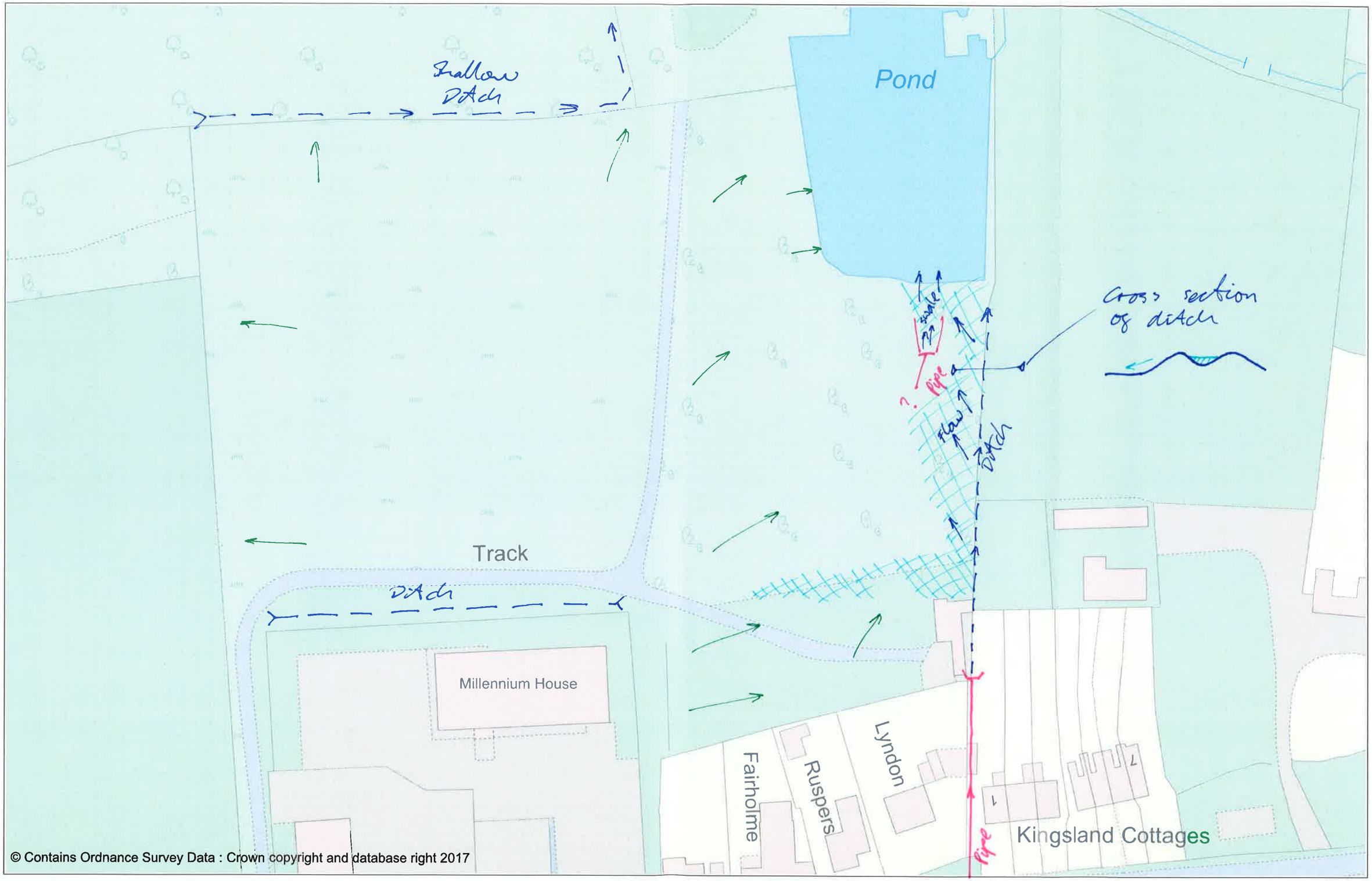
Printed: 18-5-2017

Map Centre (Easting:Northing): 526318:118264

Scale: 1:2510

Title:
Comment:

MID SUSSEX DISTRICT COUNCIL



Printed: 18-5-2017

Map Centre (Easting:Northing): 526412:118273

Scale: 1:737

APPENDIX D
SOUTHERN WATER INCIDENT REPORT

SOUTHERN WATER SERVICES LTD., SUSSEX DIVISION
SEWERAGE & DISTRIBUTION TECHNICAL SERVICES.

SITE INSPECTIONS AT SAYERS COMMON DURING HEAVY RAINFALL ON 26th & 27th JUNE, 1997.

1. INTRODUCTION

1.1 There has been a longstanding history of sewage flooding at Kingsland Cottages, Sayers Common.

1.2 Very heavy rainfall occurred between Sunday 22nd June and Friday 27th June, 1997. This resulted in further complaints of flooding from No. 4 Kingsland Cottages on 22nd and 26th June, 1997.

1.3 An overall inspection of the catchment for surface water flooding was carried out by Sewerage & Distribution Technical Services between 6.30pm and 7pm on 26th June, 1997. Co-incidentally, the resident of No 4 Kingsland Cottages, reported sewage flooding at his home at 6.50pm on that date. From this it is assumed that the surface flooding conditions observed at the time were those which caused the sewage flooding.

1.4 A second inspection was carried out between 4.30pm and 5.30pm on 27th June, 1997. There had been comparatively little rainfall during the afternoon. Flows had abated somewhat but were still evident. A number of residents were also interviewed.

2. RESULTS OF FIRST INSPECTION ON 26/6/97

2.1 The whole catchment was inspected for surface water flooding and only the following was noted.

2.2 A substantial quantity of surface water was seen running northwards along the London Road towards its junction with Reeds Lane. Approximately 50% of this was drained by a gulley, to the east of the road junction, in the entrance to the pub car park. However, the remainder turned into Reeds Lane and flooded the recreation ground to the Southwest of the road Junction.

2.3 In Reeds Lane, all road gulleys, G3, G4 & G5, fronting Kingsland Cottages were blocked and a small quantity of runoff was seen entering the front garden of No.3, Kingsland Cottages. The quantity was insufficient to cause flooding around the buildings, however.

2.4 On the south side of Reeds Lane, there was a very large flow of water in the channel from the east. The source appeared to be fields, on either side of the road, to the west of the Environment Agency Depot. Surface water was also running into the road from the E.A. Depot. All of this flow entered road Gulley G2, which is connected to a land drainage culvert draining southwards to the east of No. 1 Kingsland Cottages. This land drainage culvert was flowing satisfactorily at half bore. The ditch, which drains to this culvert, from the front garden of property B, was also draining satisfactorily.

2.5 On the south side of the road, the front gardens of the two properties to the east of the E.A. Depot, properties A & B,

were severely flooded with surface water. IC6 which is on the foul system was under water.

3. RESULTS OF SECOND INSPECTION

3.1 This inspection concentrated on Reeds Lane, in the vicinity of Kingsland Cottages.

3.2 A large quantity of surface water was flowing out of the gulley G1 and running eastward, along the southern channel, to G2, which was draining satisfactorily.

3.3 In the front garden of property A, immediately to the East of the E.A. depot, a pond has been filled and replaced by a pipeline G1-LD2-LD1. This pipe was blocked downstream of LD2, possibly by the roots of a willow tree. The private foul drain serving this property is reported, also, to have also blocked with roots which were excavated out recently.

3.4 Manhole LD2 on the blocked culvert was full and overflowing. A large part of the front lawn was flooded to a depth of approximately 6 inches. IC8 was above the level of this flooding, at the time, but is clearly at risk.

3.5 In the next property eastwards, property B, there was very substantial flooding adjacent to the western boundary, in the drive and on the from lawn. IC6 was above the level of flooding on this occasion but flattening of the grass indicated that substantial flows had run off of the highway, into the garden, over the top of this cover.

3.6 A steady flow of surface water was running northwards from the rear of property B along its western boundary and collecting in the flooded area. Residents report that a ditch once ran along this boundary but has now been filled. The source of this runoff was a very heavily saturated lawn to the rear of property A.

3.7 The resident of property A reports that, during wet weather, there is substantial surface water runoff into the garden, from the fields to the rear and also from the Environment Agency Yard to the East.

3.8 The resident of Lyndon reports that a well once existed on his property and that during dry weather, groundwater levels never fell below eighteen inches from the surface. He also reports that the pond opposite was spring fed and confirms substantial runoff from the fields to the south of Reeds Lane.

3.9 Private ICs in the area were inspected. However, this was a single man inspection and no sewer manhole covers could be lifted.

3.10 IC1 showed a good flow of groundwater.

3.11 IC2 was dry.

3.12 IC3 showed a slight trickle of groundwater.

3.14 IC4 showed a small trickle of groundwater.

3.15 IC5 was dry.

3.16 1C6 showed a very large flow of groundwater from the drain to

the south. IC7 was leaking groundwater through a crack in the chamber wall.

3.17 IC8 showed a very large flow of groundwater, most of which appeared to be entering via a pipeline, running across the saturated rear lawn, from a mobile home.

3.18 The resident of No. 1 Kingsland Cottages reports that Surface water has run off of the road through her property in the past, but not in the last 18 months. The resident of Lyndon reports a similar problem, in the past, and has installed a drainage system in his drive to convey this runoff, under his garage, and into the rear garden. He confirms that road runoff has not been a problem in recent years.

John Challoner. 30/6/97.

REED'S LANE
Badgers
Det
0.91m FF
Fairholme
Palma-Nova
Lyndon
0.91m FF
Chesapeake
Flooded Area
DITCH
DITCH
Kingsland Cottages
Cottage
Fielding
Hramsa
Hunters Moon
Mardi Gras
Nook
IC1
IC2
IC3
IC4
IC5
IC6
IC7
IC8
G1
G2
G3
G4
G5
4 (10.1)
5 (10.1)
1
7
17.0m

APPENDIX E
PROPOSED DEVELOPMENT

Indicative Accommodation Schedule

Private Dwellings

2	x	2 bed houses
2	x	2 bed bungalows
2	x	3 bed bungalows
8	x	3 bed houses
4	x	4 bed houses

18 Total

Private Self Build Houses:

2 x 3 bed Houses

Affordable Dwellings:

4	x	2 bed houses
5	x	3 bed houses

9 Total

29 Grand Total Dwellings

Plus:

Site for Doctor's Surgery (0.12 Acres) consisting of a two storey building of circa 1100 square feet, with 6 No. parking spaces.

Swale
Pond
Public Open Space
LAP
cycle stands
Kingsland Laines
Millennium House
Site For Doctors Surgery
Kingsland Cottages
Presentation House
Badgers
Fairholme
Ruspers
King Business Centre
Pavilion House
REED'S LANE
Chesapeke
Homelands
Buff Cottage
Hramsa
La Massana
OSBORN CLOSE

0 5 10 15 20 25 30 35m

cmyk PLANNING AND DESIGN
CMYK (Planning & Design) Ltd
6 The Gavell Centre, Porters Wood
St Albans, Herts. AL3 6PQ
t: 01727 830123 e: email@cmykuk.net
www.cmykuk.net

For: reside.

Reside Developments Ltd
The Dutch House, 132-134 High Street, Dorking, Surrey RH4 1BG
www.residedevelopments.co.uk

Job: Reeds Lane, Sayers Common.
Title: Illustrative Site Layout
Scale: 1:500 @A1
Date: Oct 2017
Drg.No: 1636 / P / 10.02
Rev:

APPENDIX F
ENVIRONMENT AGENCY CORRESPONDENCE

Ryan Whitfield

From: SSD Enquiries [SSDEnquiries@environment-agency.gov.uk]
Sent: 18 October 2017 11:09
To: Kathryn Olive
Subject: 171008: SSD62360 - Flood Information Request - BN6 9LS

Dear Ms Olive,

Thank you for your request of 4 October 2017 to use Environment Agency Product 4 data for 17 Reeds Ln, Sayers Common, Hassocks, BN6 9LS.

The Environment Agency's records indicate that the above property is located in Flood Zone 1 (land assessed as having less than 0.1% (1 in 1,000) chance of flooding in any given year from rivers or the sea). Therefore the likelihood of flooding in this area is estimated as 'very low'.

The above property is approximately 1,300 metres away from Flood Zone 3.

We are therefore unable to provide data from our detailed fluvial or tidal models which is relevant to your site.

Please be aware that in February 2016 the Environment Agency updated its guidance on climate change allowances. The standard allowance of adding 20% to peak flows – as per previous guidance in the National Planning Policy Framework, may not be applicable for the purposes of informing development proposals. It is possible that our current modelling has under estimated flood risk when taking climate change into consideration. This does not however have an effect on Flood Zone 2 or 3. For further information please visit:

https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

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

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

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

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

In regards to your queries on flooding history, we hold no record of previous flooding events affecting this site. We recommend that you contact the lead local flooding authority, West Sussex County Council or the local authority, Mid Sussex District Council for a more comprehensive flood history check.

For information about how surface water flooding is managed in the area please contact the Lead Local Flood Authority, West Sussex County Council.

If you have any queries or would like to discuss the content of this letter further please call us on 03708 506506 or reply to this email.

Yours sincerely

Matthew Murphy
Customers and Engagement
Environment Agency | Chichester Office, Oving Road, Chichester, West Sussex, PO20 2AG

Matthew.Murphy@environment-agency.gov.uk

Working days: Monday to Friday

From: KOlive@rsk.co.uk [mailto:KOlive@rsk.co.uk]
Sent: 04 October 2017 10:01
To: Enquiries, Unit <enquiries@environment-agency.gov.uk>
Subject: 171004/BA05 Flood Information Request - Sayers Common, Hassocks (881259)

Dear Sir/Madam,

Please could I order information on flooding and drainage for the following site in order to inform a Flood Risk Assessment:

17 Reeds Ln,
Sayers Common,
Hassocks
BN6 9LS

Grid reference – 526432 E, 118224 N **LOCATION PLAN ATTACHED**

I would like all the flooding information you have including the following, if available:

- Confirmation of the site's Flood Zone designation, alternatively could you provide the flood flows and levels for a range of return periods including the 1 in 2, 10, 30, 100, 100+CC, 200, 1000,
- Information on the recently published climate change guidance for this area and how this may impact on the data available for the area,
- Information on surface water flood risk including flow pathways and depths,
- Information on historic flooding,
- Information on flood defences in the area, if any,
- Any data on existing surface water discharges to the surrounding watercourses,
- Any data on groundwater flooding,
- Any information on reservoir flooding; and,
- Any information on culverted watercourses or privates sewers which you know of which do not show up on the public sewer records.

Finally, please could you provide any recommendation on how the surface water is to be managed; for example, restrictions in discharge rates the requirements for SuDS, possible discharge locations and attenuation requirements?

We have a relatively quick turn around on this project and would therefore appreciate a quick response.

If you have any queries please don't hesitate to contact me.

Kind regards,

Kathryn

Kathryn Olive
Administrator
Land & Development Engineering

RSK
14 Beecham Court, Pemberton Business Park, Wigan, WN3 6PR, UK

Switchboard: +44 (0) 1942 493255
http://www.rsk.co.uk

APPENDIX G
MID SUSSEX COUNCIL MEETING COMMENTS

MSDC PLANNING CONSULTATION RESPONSE – DRAINAGE

Application Number:	Pre-App
Planning Officer:	Joanne Fisher
Engineering Officer:	Scott Wakely
Date:	18/05/2017
Location:	Reeds Lane Sayers Common
Development Proposal:	36 dwelling

Recommendation:

Advice

Summary and overall assessment

This proposed development will need to fully consider how it will manage surface water run-off. Guidance is provided at the end of this consultation response for the various possibly methods. However, the hierarchy of surface water disposal will need to be followed and full consideration will need to be made towards the development catering for the 1 in 100 year storm event plus extra capacity for climate change.

As this is for multiple dwellings, we will need to see a maintenance and management plan that identifies how the various drainage systems will be managed for the lifetime of the development, who will undertake this work and how it will be funded.

The proposed development drainage will need to:

- Follow the hierarchy of surface water disposal.
- Protect people and property on the site from the risk of flooding
- Avoid creating and/or exacerbating flood risk to others beyond the boundary of the site.
- Match existing greenfield rates and follow natural drainage routes as far as possible.
- Calculate greenfield rates using IH124 or a similar approved method. SAAR and any other rainfall data used in run-off storage calculations should be based upon FEH rainfall values.
- Seek to reduce existing flood risk.
- Fully consider the likely impacts of climate change and changes to impermeable areas over the lifetime of the development.
- Consider a sustainable approach to drainage design considering managing surface water at source and surface.

- Consider the ability to remove pollutants and improve water quality.
- Consider opportunities for biodiversity enhancement.

Flood Risk

The proposed development is within flood zone 1 and is deemed as low fluvial flood risk.

The proposed development does have areas within the site that are identified as having possible pluvial flood risk. These are the eastern side of the site, part of which is the existing wetland/pond area.

There are not any historic records of flooding occurring on this exact site. This does not mean that flooding has never occurred here, instead, that flooding has just never been reported. There has been reported flooding in this area of Sayers Common and parts of Reeds Lane.

The public foul sewers of Reeds Lane surcharged and flooded properties as a result of surface water entering the system in the 1990's. Southern Water constructed capacity relief within the system to reduce the likelihood of this flooding occurring.

Parts of Reeds Lane are prone to surface water flooding during heavy rainfall, and there are records of flooding here.

There appears to be a shallow boundary ditch along the north and south boundary. There is a ditch along the eastern boundary, but this is in poor condition, with fallen trees and being heavily silted; and there is evidence that water has escaped the banks of the ditch and has flowed across the site.

The eastern ditch appears to be fed from a surface water drain serving part of Reeds Lane, though the actual outlet could not be found at the time of site visit due to vegetation.

There is a 6" outlet pipe in the site that discharges to a ground structure that looks like a swale, which in turn discharges to the wetland pond area. The origins of this pipe are unknown, but appear to be surface water.

Flood Risk and Drainage Information for Planning Applications

The level of drainage information necessary for submission at each stage within the planning process will vary depending on the size of the development, flood risk, site constraints, proposed sustainable drainage system etc. The table below provides a guide and is taken from the Practice Guidance for the English non-statutory SuDS Standards

Pre-app	Outline	Full	Reserved	Discharge	Document submitted
√	√	√			Flood Risk Assessment / Statement (checklist)
√	√	√			Drainage Strategy / Statement & sketch layout plan (checklist)
	√				Preliminary layout drawings
	√				Preliminary "Outline" hydraulic calculations
	√				Preliminary landscape proposals
	√				Ground investigation report (for infiltration)
	√	√			Evidence of third party agreement for discharge to their system (in principle / consent to discharge)
		√		√	Maintenance program and on-going maintenance responsibilities
		√	√		Detailed development layout
		√	√	√	Detailed flood and drainage design drawings
		√	√	√	Full Structural, hydraulic & ground investigations
		√	√	√	Geotechnical factual and interpretive reports, including infiltration results
		√	√	√	Detailing landscaping details
		√	√	√	Discharge agreements (temporary and permanent)
		√	√	√	Development Management & Construction Phasing Plan

Additional information may be required under specific site conditions or development proposals

Useful links:

Planning Practice Guidance – Flood Risk and Coastal Change

Flood Risk Assessment for Planning Applications

Sustainable drainage systems technical standards

Water.People.Places.- A guide for master planning sustainable drainage into developments

Climate change allowances - Detailed guidance – Environment Agency Guidance

Further guidance is available on the Susdrain website at http://www.susdrain.org/resources/

Guidance for the level of information required is set out below:

For a development located within Flood Zone 2, Flood Zone 3, which is greater than 1 hectare in area, or where a significant flood risk has been identified:

A Flood Risk Assessment [1] will need to be submitted that identifies what the flood risks are and how they will change in the future. Also whether the proposed development will create or exacerbate flood risk, and how it is intended to manage flood risk post development.

[1] *This level of assessment will need to be carried out to our satisfaction by a suitably qualified person.*

For the use of SuDS [1] [2] [3]***:***

Written Statement (HCWS 161) – Department for Communities and Local Government – sets out the expectation that sustainable drainage systems will be provided to new developments wherever this is appropriate.

Percolation tests, calculations, plans and details will need to be submitted to demonstrate that the development will be able to cater for the 1 in 100 year storm event plus climate change percentages, for some developments this will mean considering between 20 and 40% additional volume for climate change but scenarios should be calculated and the worst case taken as this will be precautionary [4]. A maintenance and management plan will also need to be submitted that shows how all SuDS infrastructure will be maintained so it will operate at its optimum for the lifetime of the development. This will need to identify who will undertake this work and how it will be funded. Also, measures and arrangements in place to ensure perpetuity and demonstrate the serviceability requirements, including scheduled maintenance, inspections, repairs and replacements, will need to be submitted. A clear timetable for the schedule of maintenance can help to demonstrate this.

[1] *Suitable SuDS Guidance can be found using CIRIA Guidance Document C697 "SuDS Manual"*

[2] *Climate Change consideration should be calculated following Environment Agency Guidance*

[3] *Approved method of soakaway design include BRE – Digest 365 "Soakaway Design"*

[4] *Submitted SuDS designs will need to be undertaken by a suitably qualified person*

For the use of attenuation, swales and soakaways [(1)]***:***

Percolation tests, calculations, plans and details will need to be submitted to demonstrate that the development will be able to cater for the 1 in 100 year storm event plus have 40% capacity for climate change[(2)].

[(1)] *Approved method of soakaway design include BRE – Digest 365 "Soakaway Design"*

[(2)] *Climate Change consideration should be calculated following Environment Agency Guidance*

For the use of Public Sewers [(1)]***:***

Copies of the approval of the adoption of foul and surface water sewers and/or the connection to foul and surface water sewers from the sewerage undertaker, which agrees a rate of discharge, will need to be submitted.

[(1)]Any design and construction of sewers should follow the standards of the WRC guidance "Sewers for Adoption" and should be agreed with the appropriate sewerage authority.

For the proposal of works to an Ordinary Watercourse:

If works (including temporary works) are undertaken within, under, over or up to an Ordinary Watercourse these works are likely to affect the flow in the watercourse and an Ordinary Watercourse Consent (OWC) may need to be applied for. OWC applications can be discussed and made with Mid Sussex District Council, Scott Wakely, 01444 477 005. There is guidance and a form available here

For the use of watercourse to discharge surface water [(1)]***:***

Calculations, plans and details will need to be submitted that demonstrate that discharge from the proposed development will be restricted to Greenfield run-off rate or QBar run-off rate, whichever provides the better rate of discharge[(2)]. This will need to be for up to the 1 in 100 year storm event plus 40% capacity for climate change.

[(1)] *In accordance with The Land Drainage Act 1991.*

[(2)] *Approved methods to calculate this include:*

Institute of Hydrology - Report 124 – "Flood Estimation for Small Catchments"
Centre for Ecology & Hydrology 1999 – "Flood Estimation Handbook" - (FEH)
WinDes Software – Generated FEH Output
(For Highway) DMBR Standards HA106/04 – "Drainage of Runoff from Natural Catchments"

For the presence of an Ordinary Watercourse running through or adjacent to the site:

Consultation will need to be made with Mid Sussex District Council if there is a watercourse running through or adjacent to the proposed development. It is common practice to require the development to leave a strip of land, at least 5 to 8 metres wide, in order to provide access for future maintenance.

For the presence of a Public Sewer running under or adjacent to the proposed development:

Consultation will need to be made with the sewerage undertaker if there is a Public Sewer running under or adjacent to the proposed development. Building any structure over or within close proximity to such sewers will require prior permission from the sewerage undertaker [(1)]. Evidence of approvals to build over or within close proximity to such sewers will need to be submitted.

[(1)]Southern Water and Thames Water provide suitable online guidance notes for the building over or near Public Sewers.

For the presence of a Mid Sussex District Council (MSDC) owned culvert running under or adjacent to the site:

Consultation will need to be made with Mid Sussex District Council if there is a MSDC owned culvert running under or adjacent to the proposed development. Building any structure over or within close proximity to such culverts will require prior permission from Mid Sussex District Council. Normally it will be required that an "easement" strip of land, at least 5 to 8 metres wide, is left undeveloped to ensure that access can be made in the event of future maintenance and/or replacement. This matter can be discussed with Mid Sussex District Council, Scott Wakely, 01444 477 055.

APPENDIX H
GREENFIELD RUNOFF CALCULATIONS

ICP SUDS Mean Annual Flood

Input

Return Period (years)	1	Soil	0.450
Area (ha)	1.374	Urban	0.000
SAAR (mm)	800	Region Number	Region 7

Results l/s

QBAR Rural	7.1
QBAR Urban	7.1
Q1 year	6.0
Q1 year	6.0
Q30 years	16.0
Q100 years	22.5

APPENDIX I
ATTENUATION BASIN CALCULATIONS

18 Frogmore Road
Hemel Hempstead
Herts, HP3 9RT

Date 12/01/2018 15:44 | Designed By RBrenton
File basin size calcs.... | Checked By
Elstree Computing Ltd | Source Control W.12.5

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	15.500	0.400	6.6	180.1	O K
30 min Summer	15.614	0.514	6.6	240.5	O K
60 min Summer	15.723	0.623	6.6	302.5	Flood Risk
120 min Summer	15.818	0.718	6.6	359.8	Flood Risk
180 min Summer	15.860	0.760	6.6	386.0	Flood Risk
240 min Summer	15.880	0.780	6.7	398.9	Flood Risk
360 min Summer	15.898	0.798	6.7	410.4	Flood Risk
480 min Summer	15.898	0.798	6.7	410.3	Flood Risk
600 min Summer	15.893	0.793	6.7	407.2	Flood Risk
720 min Summer	15.887	0.787	6.7	403.1	Flood Risk
960 min Summer	15.871	0.771	6.6	392.7	Flood Risk
1440 min Summer	15.832	0.732	6.6	368.4	Flood Risk
2160 min Summer	15.769	0.669	6.6	330.2	Flood Risk
2880 min Summer	15.707	0.607	6.6	293.0	Flood Risk
4320 min Summer	15.582	0.482	6.6	223.1	O K
5760 min Summer	15.463	0.363	6.6	161.0	O K
7200 min Summer	15.373	0.273	6.6	117.2	O K
8640 min Summer	15.316	0.216	6.5	90.7	O K
10080 min Summer	15.282	0.182	6.3	75.6	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	131.851	26
30 min Summer	88.566	40
60 min Summer	56.713	70
120 min Summer	35.004	128
180 min Summer	25.973	186
240 min Summer	20.877	244
360 min Summer	15.365	362
480 min Summer	12.341	460
600 min Summer	10.402	512
720 min Summer	9.042	574
960 min Summer	7.241	702
1440 min Summer	5.284	976
2160 min Summer	3.848	1388
2880 min Summer	3.068	1792
4320 min Summer	2.226	2560
5760 min Summer	1.771	3280
7200 min Summer	1.483	3896
8640 min Summer	1.284	4576
10080 min Summer	1.137	5240

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m^3)	Status
15 min Winter	15.543	0.443	6.6	202.4	O K
30 min Winter	15.667	0.567	6.6	270.4	O K
60 min Winter	15.787	0.687	6.6	340.6	Flood Risk
120 min Winter	15.892	0.792	6.7	406.5	Flood Risk
180 min Winter	15.940	0.840	6.9	437.7	Flood Risk
240 min Winter	15.965	0.865	7.0	454.1	Flood Risk
360 min Winter	15.990	0.890	7.1	470.6	Flood Risk
480 min Winter	15.995	0.895	7.1	474.1	Flood Risk
600 min Winter	15.990	0.890	7.1	470.6	Flood Risk
720 min Winter	15.979	0.879	7.0	463.5	Flood Risk
960 min Winter	15.960	0.860	7.0	450.4	Flood Risk
1440 min Winter	15.908	0.808	6.8	416.5	Flood Risk
2160 min Winter	15.818	0.718	6.6	359.7	Flood Risk
2880 min Winter	15.724	0.624	6.6	303.4	Flood Risk
4320 min Winter	15.527	0.427	6.6	193.7	O K
5760 min Winter	15.357	0.257	6.6	109.6	O K
7200 min Winter	15.281	0.181	6.3	75.0	O K
8640 min Winter	15.251	0.151	5.6	61.8	O K
10080 min Winter	15.233	0.133	5.0	54.1	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Winter	131.851	26
30 min Winter	88.566	40
60 min Winter	56.713	68
120 min Winter	35.004	126
180 min Winter	25.973	182
240 min Winter	20.877	240
360 min Winter	15.365	354
480 min Winter	12.341	464
600 min Winter	10.402	568
720 min Winter	9.042	654
960 min Winter	7.241	748
1440 min Winter	5.284	1056
2160 min Winter	3.848	1504
2880 min Winter	3.068	1936
4320 min Winter	2.226	2724
5760 min Winter	1.771	3288
7200 min Winter	1.483	3832
8640 min Winter	1.284	4504
10080 min Winter	1.137	5240

Model Details

Storage is Online Cover Level (m) 16.000

Tank or Pond Structure

Invert Level (m) 15.100

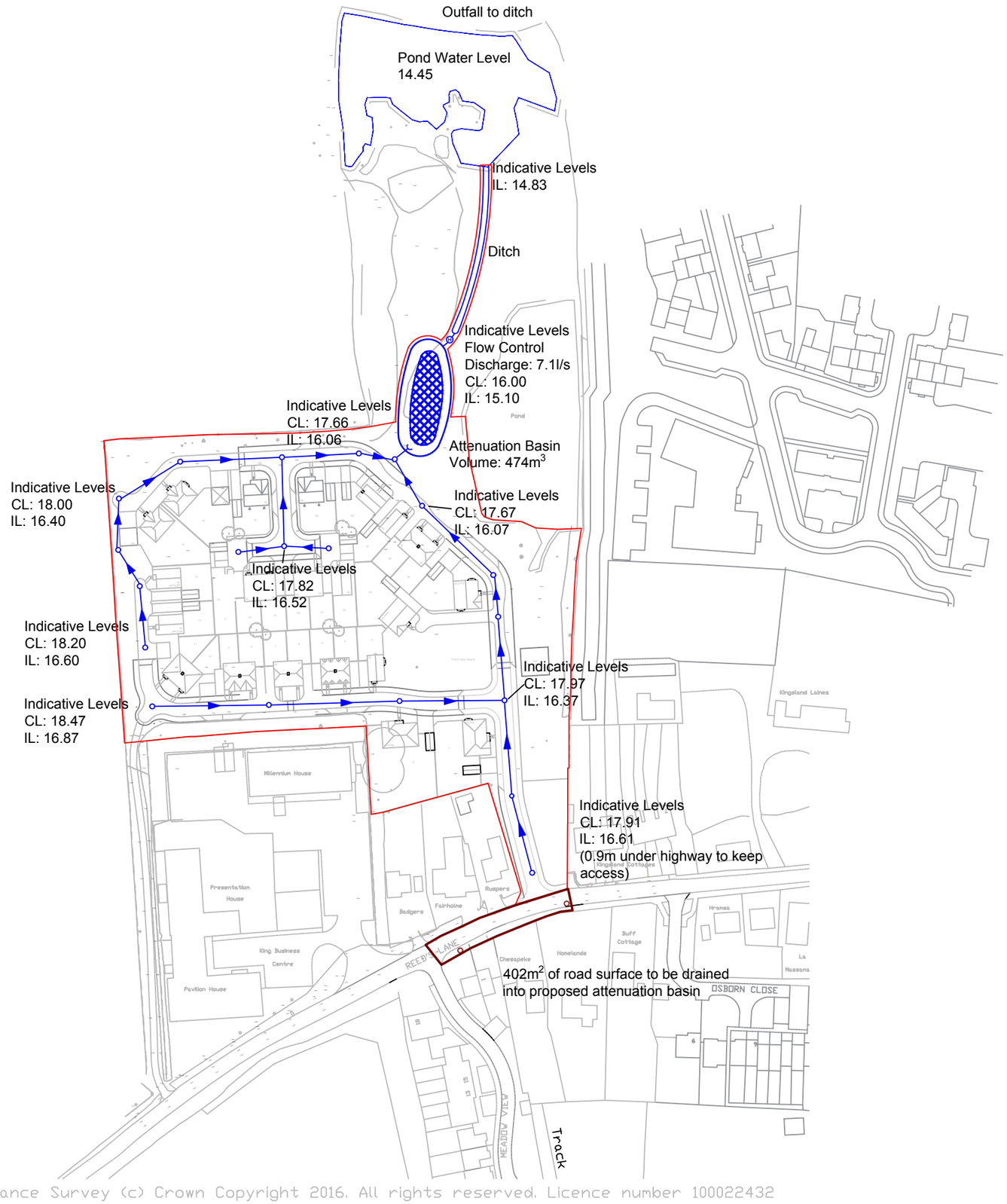
Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	385.0	0.900	676.1

Hydro-Brake® Outflow Control

Design Head (m) 0.900 Diameter (mm) 114
Design Flow (l/s) 7.1 Invert Level (m) 15.100
Hydro-Brake® Type Md6 SW Only

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.6	1.200	8.1	3.000	12.8	7.000	19.6
0.200	6.5	1.400	8.8	3.500	13.9	7.500	20.3
0.300	6.6	1.600	9.4	4.000	14.8	8.000	21.0
0.400	6.2	1.800	9.9	4.500	15.7	8.500	21.6
0.500	6.1	2.000	10.5	5.000	16.6	9.000	22.2
0.600	6.2	2.200	11.0	5.500	17.4	9.500	22.9
0.800	6.7	2.400	11.5	6.000	18.2		
1.000	7.4	2.600	12.0	6.500	18.9		

APPENDIX J
OUTLINE SURFACE WATER DRAINAGE STRATEGY



Notes
Do not scale from this drawing
Layout provided by Gladman
Drawing is indicative and subject to change following layout revisions
Soakage testing should be undertaken and drawing is subject to change

Key

- Indicative Surface Water Pipes
- Indicative Surface Water Ditch
- Indicative Surface Water Basin
- Flow Control Device
- Red Line Boundary
- Road Surface - Offsite

Rev.	Date	Amendment	Drawn	Chkd.	Appd.
P1	OCT'17	ISSUE	RW		

RSK
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Client
Reside Developments Ltd

Project Title
The Old Brickworks
Sayers Common

Status
For Issue

Drawing Title
Outline Surface Water Drainage Strategy

Drawn	Date	Checked	Date	Approved	Date
RW	Oct 2017	CW	Oct 2017	CW	Oct 2017

Scale	Orig Size	Dimensions
1:2500	A3	m

Project No.	Drawing File
881259	

Drawing No.	Rev.
10-01	P2

Scale
0 50 100 150 200m

File Location: L:\001 JOBS LIVE WIGAN\881259 - SAYERS COMMON RESIDEVGRAPH\FLOOD RISK\881259 10_01 INDICITIVE DRAINAGE STRATEGY P2.DWG

Report presented by

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