THOMAS CONSULTING
STRUCTURAL & CIVIL DESIGN ENGINEERS

L9434/FRA/02/JP

FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY

AT

Oak Tree Farm, Drayton Lane
Drayton Bassett
B78 3EF

FOR

Grosvenor Gospel Hall Trust

REPORT VERIFICATION

Site Address	Oak Tree Farm, Drayton Lane, Drayton Bassett,B78 3EF

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1 INTRODUCTION

1.1 Project Scope

1.1.1 Thomas Consulting has been commissioned by Grosvenor Gospel Hall Trust to carry out a flood risk assessment for a Gospel Hall, at Oak Tree Farm, Drayton Lane, Drayton Bassett, B78 3EF

1.1.2 It is understood that this assessment will be submitted to the Planning Authority as part of a planning application. Specifically, this assessment intends to:

- Give a brief background to the location, local geology and hydrogeology of the site in question.
- Assess the existing flood risk to the site, including the potential effects of Fluvial, Surface Water, Groundwater, Sewers and Other forms of flooding to the site.
- Give a brief overview of the surrounding services that could potentially affect the sites development such as existing watercourses, sewers and any ground condition information obtained from individual/third party studies.
- Outline any flood mitigation methods if required.
- Report findings and recommendations.

1.1.3 This assessment is carried out in accordance with the requirements of the National Planning Policy Framework (NPPF) dated February 2019 and its accompanied Planning Practice Guidance (PPG). Other documents which have been consulted include:

- Defra/Environment Agency, The Town and Country Planning Order, 2015, No.596, Article 3.

1.2 Data Collection

1.2.1 To assist with this report, the data collected included:

- OS Maps, 2020.
- Environment Agency Flood Maps for Planning, 2018, GOV.UK.
- British Geological Survey (BGS), Geoindex Onshore, Superficial Deposits and Bedrock Geology, 1: 50,000.
- Land Information Systems (LandIS) – Soilscapes Viewer, January 2016.
- Environment Agency Groundwater Vulnerability Maps, Defra Magic Map.
- Environment Agency Main River Map, 2019.
- Environment Agency Surface Water Flood Map, 2020, GOV.UK.

1.2.2 All third-party data used in this study has been checked and verified prior to use in accordance with Thomas Consulting Ltd Quality Assurance procedures.

2 SITE CHARACTERISTICS

2.1 Site Location & Topography

2.1.1 The site is located at Oak Tree Farm, Drayton Lane, Drayton Bassett, B78 3EF. The approximate Ordnance Survey (OS) grid reference for the site is 417743E 300105N and the location of the site is shown in Figure 1.

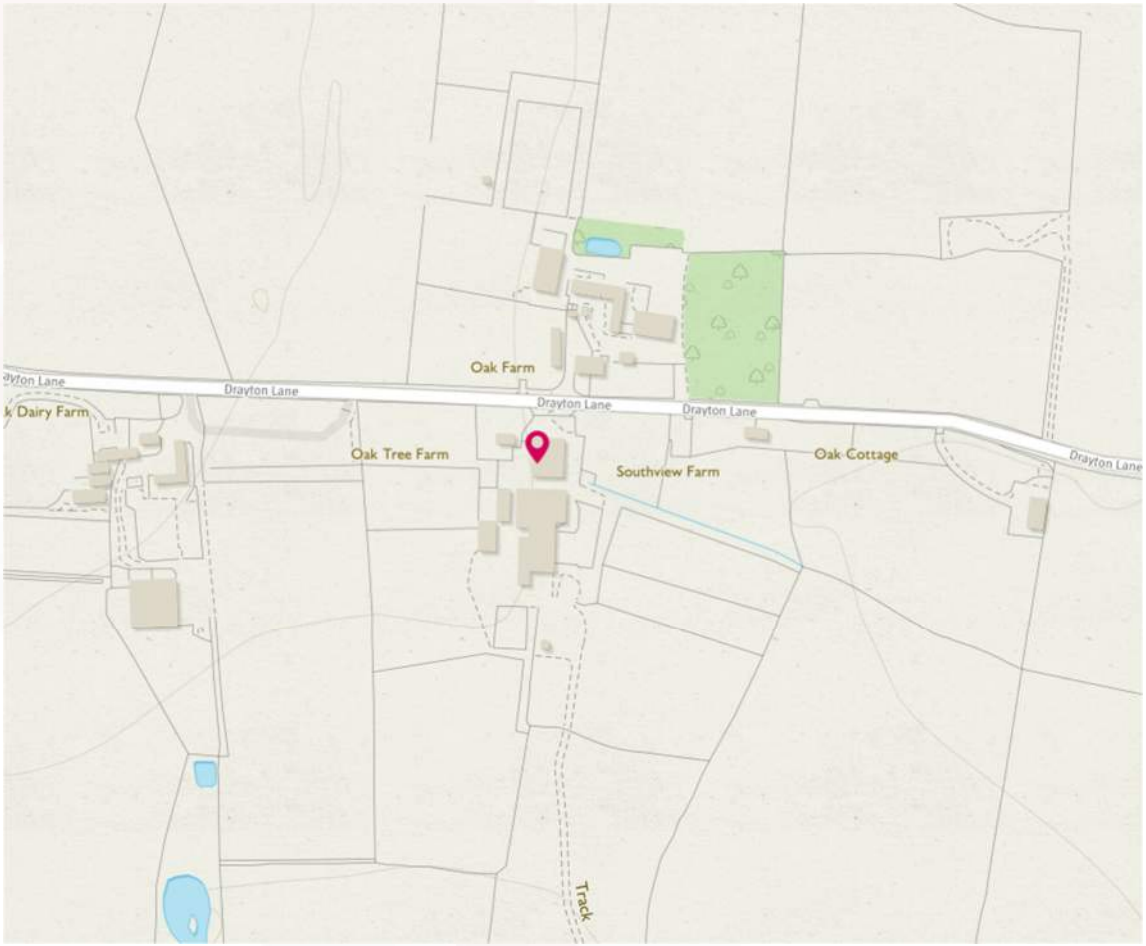


Figure 1: Site location plan (Source: OS Maps, 2020)

2.1.2 The site covers a total area of approximately 1.05 ha and comprises farmland including livestock barns.

2.1.3 The site is located approximately 1.5km west of the village of Drayton Bassett. The site is slightly sloping to the south/south-east with average elevations between 90.5 – 89.5 m AOD and is currently made up of hardstanding surfaces comprising macadam and concrete material with numerous barns and portal frame livestock structures.

2.1.4 The site is bound to the north by Drayton Lane and beyond this, residential dwellings and a small business park. To the east, south and west is agricultural farm/green land.

2.1.5 A topographical survey to Ordnance Datum has been provided by Beacon Land Surveys and can be seen on Drawing Number 20-035-01 (Appendix B). The topographical survey shows that there is little variation in ground levels across the main farm site and slopes off slightly to the south.

Beyond the farms boundary the site does start to slope off in quite a steep manner where it drops a further 2 meters to the watercourse.

2.2 Brief on Site Proposals

2.2.1 It is the Client's intention to convert the two main barns into a storage unit and a gospel hall. The land to the south and west is proposed for parking. The site will also consist of an access road from Drayton Lane as per the existing arrangement of the farm.

2.2.2 Drawings by JMP Architects Ltd (Appendix C) shows access to the proposed site being provided via 1 main access road, with an additional emergency access road to the east and parking provisions to the west and south of the site. Both the main access road and associated pedestrian access points will remain private along with any drainage features serving the site.

2.3 Environment Agency Flood Map for Planning

2.3.1 National Planning Policy Framework (NPPF) Flood Zones comprise Flood Zone 1, Flood Zone 2 and Flood Zone 3. The Environment Agency's Indicative Flood Map for Planning (Figure 2) shows that the site is located within the NPPF defined Flood Zone 1.

2.3.2 Flood Zones are based on an areas Annual Exceedance Probability (AEP) of River or Sea Flooding. For example, Flood Zone 1 has a 'Low Probability' of flooding as it has an AEP of <0.1% (Less than 1 in 1000 year) of occurring in any one year. Flood Zone 2 has a 'Medium Probability' having an AEP of 0.1-1.0% (1 in 1000 – 1 in 100 year) chance of river flooding, or 0.1-0.5% (1 in 1000 – 1 in 200 year) chance of tidal/sea flooding.

2.3.3 Flood Zones 3 is split between 'a' and 'b' classifications. Flood Zone 3a has a 'High Probability' of flooding as it has an AEP of >1.0% (More than 1 in 100 year) chance of river flooding, or >0.5% (More than 1 in 200 year) chance of sea/tidal flooding. Flood Zone 3b (The Functional Floodplain) comprises land where water has to flow or be stored in times of flooding. Local planning authorities should identity in the Strategic Flood Risk Assessments areas of function floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map for Planning).

2.3.4 The extent of the flood zones do not take into account the presence of any formal flood defences, or other features which also act as informal flood defences.

2.3.5 The site is located within Flood Zone 1 but is classed as a Major Development due to being over 1ha in size, in accordance with the Town and Country Planning Order in 2015 by Defra and the EA. As this is the case a brief flood risk assessment is required with more emphasis based on the drainage strategy.

2.3.6 The NPPF is accompanied by the Planning Practice Guidance (PPG) documents which classifies each development into a vulnerability class, depending on the type of development, which are outlined in Figure 3. According to the PPG a gospel hall would fall under the "Less Vulnerable" class. "Less Vulnerable" developments are acceptable in Flood Zone 1 as shown in Figure 4.

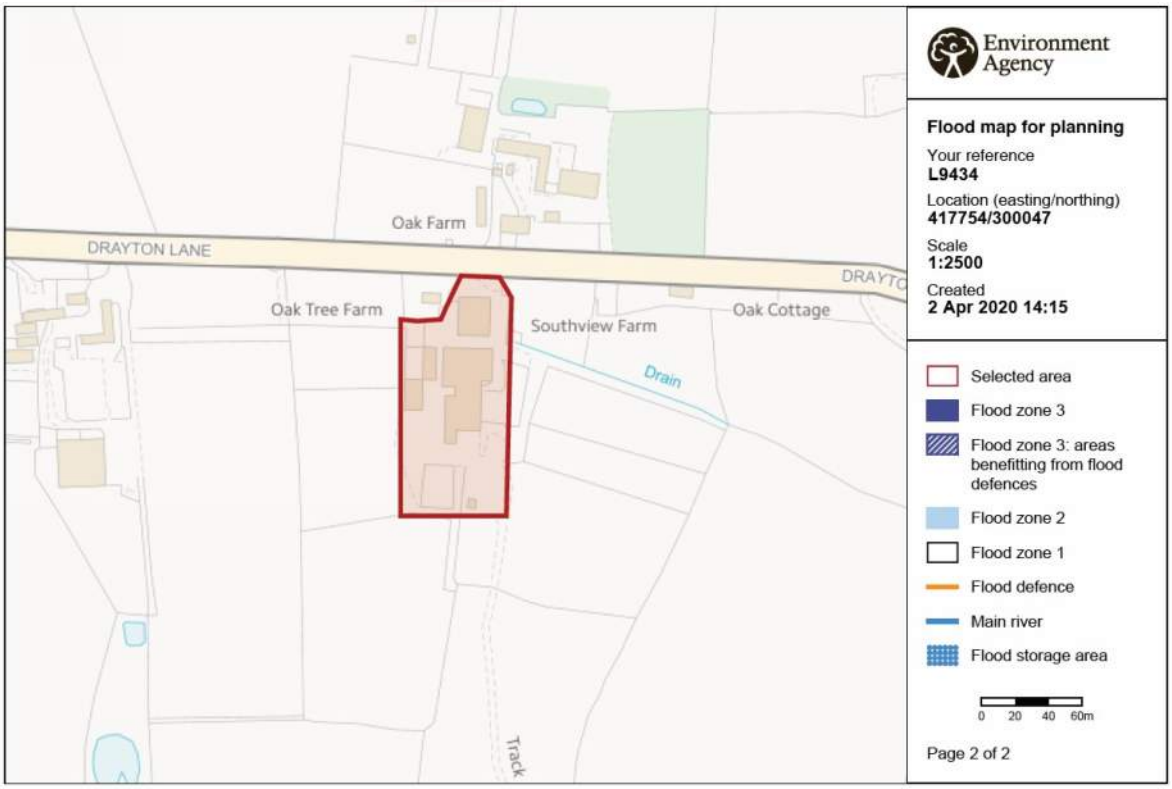


Figure 2: Environment Agency Flood Zone Map (Source: Environment Agency, 2018, GOV.UK)

Vulnerability Classification	Development
Essential Infrastructure	• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk • Essential utility infrastructure, which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood • Wind turbines
Highly Vulnerable	• Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operation during flooding. • Emergency dispersal points • Basement dwellings • Caravans, mobile homes and park homes intended for permanent residential use • Installations requiring hazardous substances consent
More Vulnerable	• Hospitals • Residential institutions such as residential care homes, children's homes, prisons and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. • Non-residential uses for health services, nurseries and education establishments. • Landfill and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short let caravans and camping, subject to a specific warning and evacuation plan
Less Vulnerable	• Police, ambulance and fire stations which are NOT required to be operational during flooding. • Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distributions; non-residential institutions not included in the 'more vulnerable' class; and assemble and leisure. • Land and buildings used for agriculture and forestry • Waste treatment (except landfill & hazardous waste facilities) • Minerals working & processing (except for sand & gravel working) • Water treatment works which do not need to remain operational during times of flood • Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.
Water-Compatible Development	• Flood control infrastructure • Water transmission infrastructure & pumping stations • Sewage transmission infrastructure & pumping stations • Sand & gravel working • Docks, marinas and wharves • Navigation facilities • Ministry of Defence installations • Ship building, repairing & dismantling, dockside fish processing & refrigeration & compatible activities requiring a waterside location • Water based recreation (excluding sleeping accommodation) • Lifeguard and coastguard stations • Amenity open space, nature conservation & biodiversity, outdoor sports and recreation and essential facilities such as changing rooms • Essential ancillary sleeping or residential accommodation for staff required by uses in this category subject to a specific warning & evacuation plan.

Figure 3: NPPF Flood Risk Vulnerability Classification (Source: National Planning Practice Guidance, 2014)

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	✗	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	✗	✗	✗	✓*

Key:

✓ Development is appropriate

✗ Development should not be permitted.

Figure 4: NPPF Flood Risk Vulnerability Classification (Source: National Planning Practice Guidance, 2014)

2.4 Site Geology & Hydrogeology

British Geological Survey (BGS) and Land Information Systems (LandIS) mapping indicates the site is underlain by the geology sequences outlined in Table 1. The EA Groundwater Vulnerability Map indicates there are no Groundwater Source Protection Zones or Groundwater Abstraction Licenses within 5 km of the site. The development site overlies a lowly productive aquifer with “Medium” vulnerability.

Principal Aquifers - These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.

Secondary A Aquifers - permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

Secondary B Aquifers - predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.

Secondary (Undifferentiated) Aquifers - has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

Geological Layer	Classification	Description	Aquifer Class
Soil	Soilscape 18	Slowly permeable seasonally wet, slightly acid but base-rich loamy and clayey soils	N/A
Superficial (Drift)	No Records	N/A	N/A
Bedrock (Solid)	Gunthorpe Member	Mudstone	Secondary B

Table 1: Site Geological Summary

2.5 Existing Watercourses

2.5.1 According to the EA Main River Maps the closest known watercourse is 1.55km north from the site. This watercourse is called Bourne Brook and is 1.67km in length running to the south of Drayton Manor Pleasure Park.

2.6 Existing Sewers

2.6.1 Reference to the Severn Trent sewer records (included in Appendix A), indicates that there are no sewers surrounding or running through the site.

2.7 Ground Conditions

2.7.1 On 19/03/2020 two trial pits were dug down to a depth of 2m on site. Soakaways tests were conducted in each. The first trial pit held its water level and didn't change, the second rose 65mm in 2 hours due to water running in from the saturated ground above.

2.7.2 General ground conditions consisted of made ground to be at depths between 0.25 and 0.6m deep across the site, underlain by red mouldable sandy clay to 1.65m deep below ground level.

2.7.3 The majority of the barns had roof gutters with downpipes draining into a system which discharged freely to the east of the site into the adjacent fields.

3 ASSESSMENT OF FLOOD RISK

3.1 Flood Risk Terminology

3.1.1 Flood risk considers both the probability and consequence of flooding. Flood events are often described in terms of their probability of recurrence or probability of occurring in any one year. The threshold between a medium flood and a large flood is often regarded as the 1 in 100-year event. This is an event which statistical analysis suggests will occur on average once every hundred years. However, this does not mean that such an event will not occur more than once every hundred years. Table 2 shows the event return periods expressed in years and annual expectance probabilities as a fraction and a percentage. For example, a 1 in 100-year event has a 1% probability of occurring in any one year, i.e. a 1 in 100 probability. A 1000-year event has a 0.1% probability of occurring in any one year, i.e. a 1 in 1000 probability.

Return Period (Years)	Annual Exceedance Probability (AEP)	
	Fraction	Percentage
2	0.5	50%
10	0.1	10%
25	0.04	4%
50	0.02	2%
100	0.01	1%
200	0.005	0.5%
500	0.002	0.2%
1000	0.001	0.1%

Table 2: Flood return periods and exceedance probabilities

3.2 Fluvial Flood Risk

3.2.1 The site is not located in proximity to a main river. The nearest main river/watercourse is Bourne Brook located 1.55km north from the site and is 1.67km in length running to the south of Drayton Manor Pleasure Park. This possesses no flood risk to the site. The Flood Zone 1 outline in Figure 2 and the Fluvial Flood Map in Figure 5 indicates the site is not at risk of fluvial flooding.

3.2.2 The fluvial flood map in Figure 4 shows areas that may be at risk of fluvial flooding from rivers or the sea. High risk is a >3.3% Annual Exceedance Probability (AEP) event, meaning this are has a chance of flooding of greater than 1 in 30 years (dark blue). This takes into account the effect of any flood defences in the areas. However, these defences reduce but do not completely stop the chance of flooding as they can be overtopped or fail. Medium risk is an AEP event of between 3.3-1% (1 in 30 - 1 in 100 - year, blue) chance of flooding. Low risk is an AEP event of between 1-0.1%

(1 in 100 – 1 in 1000 year, light blue) chance of flooding. Very Low risk is an AEP event of <0.1% (Less than 1 in 1000 year, white) chance of flooding.

3.2.3 The Flood Map shows the current best information on the extent of the extreme flood from rivers or the sea that would occur without the presence of flood defences. The potential impact of climate change is not considered by the mapping.

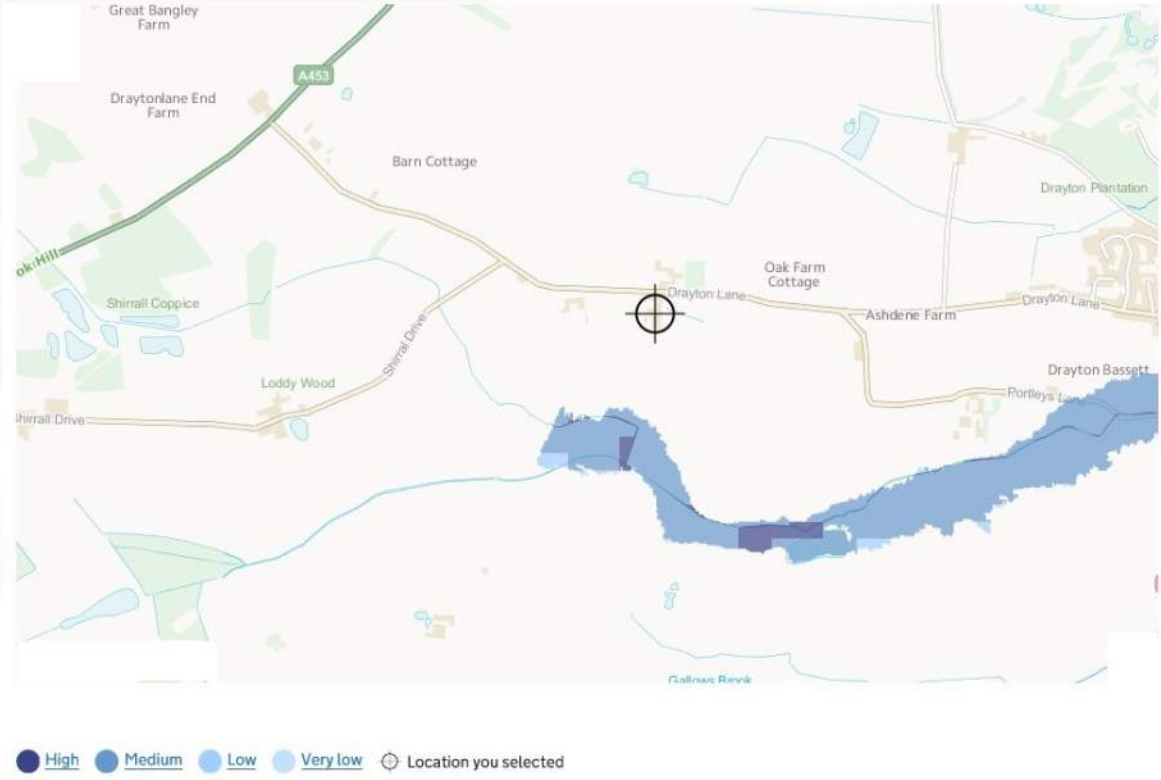


Figure 5: Environment Agency Fluvial Flood Map (Source: Environment Agency, 2020, GOV.UK)

3.3 Surface Water Flood Risk

3.3.1 The EA have mapped areas prone to surface water flooding based on historic flooding information received from the lead local flood authorities and modelling based on a LiDAR/IfSAR digital terrain model, Ordnance Survey information on urban areas and a direct rainfall approach using Flood Estimation Handbook (FEH) methodology. The critical (worst case) of the 1,3 and 6-hour storm durations have been mapped with no areal reduction factor applied. No allowance is made for climate change, the mapping therefore indicates the current predicted flood risk.

3.3.2 The maps work in the same colour coding as described above for the fluvial maps where High Risk AEP events are displayed in Dark Blue, Medium Risk in Blue, Low Risk in Light Blue and Very Low Risk in White. The maps do not account for culverts/underground drainage and due to digital terrain model resolutions may also underestimate or omit small drainage channels/ditches. Figure 6 shows the resulting predicted flood risk from surface water.

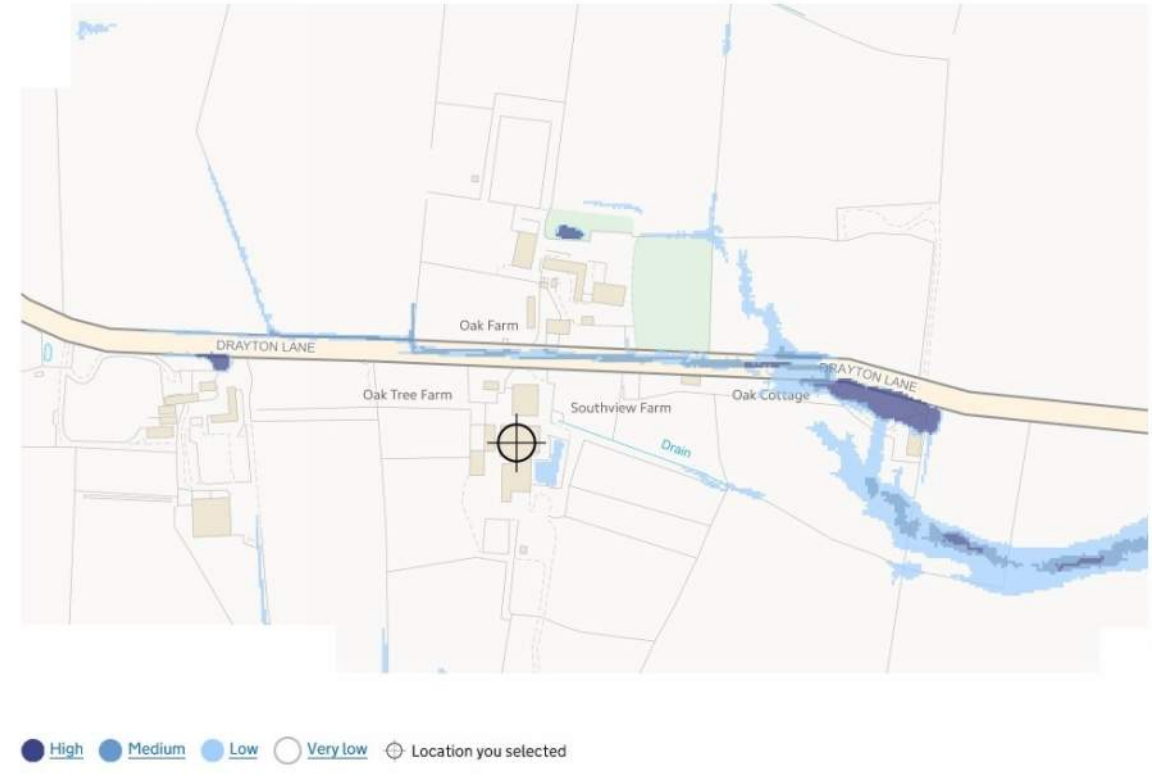


Figure 6: Environment Agency Surface Water Flood Map (Source: Environment Agency, 2020, GOV.UK)

3.3.3 The EA surface water flood map indicates the site is predominantly not at risk of surface water flooding. A small area of the site which is currently used as the access track to the existing farm to the east of the site, is shown to be at 'Low' risk with a predicted chance of flooding of between 1 in 1000 year (0.1% AEP) and 1 in 100 year (1% AEP). This is likely due to it being situated by a route marked up as "Drain" which most likely captures water in flood events and backs up to the site. As this is agricultural land its most likely unkept and blocked/compromised so consideration must be taken to remediate this area during construction.

3.3.4 The EA surface water map indicates the site is predominantly not at risk of surface water flooding, with only a low risk of flooding to the south east of the site, away from any proposed buildings.

3.4 Groundwater Flood Risk

3.4.1 BGS records have not been provided. However, although intrusive investigations did discover evidence of water ingress this was due to the saturated high-level ground caused by recent heavy

rainfall. Therefore, it is fair to assumed there is little risk of groundwater issues given the site currently drains to a drainage network to nearby adjacent land, with no existing issues.

3.5 Flooding from Artificial Sources

3.5.1 The Reservoir Flood Map which can be seen in Figure 7, indicates the maximum extend of flooding from reservoirs highlighted in light blue. As can be seen the site is not at risk of flooding from reservoirs and has no other canals or artificial sources nearby that pose any risk of flooding.

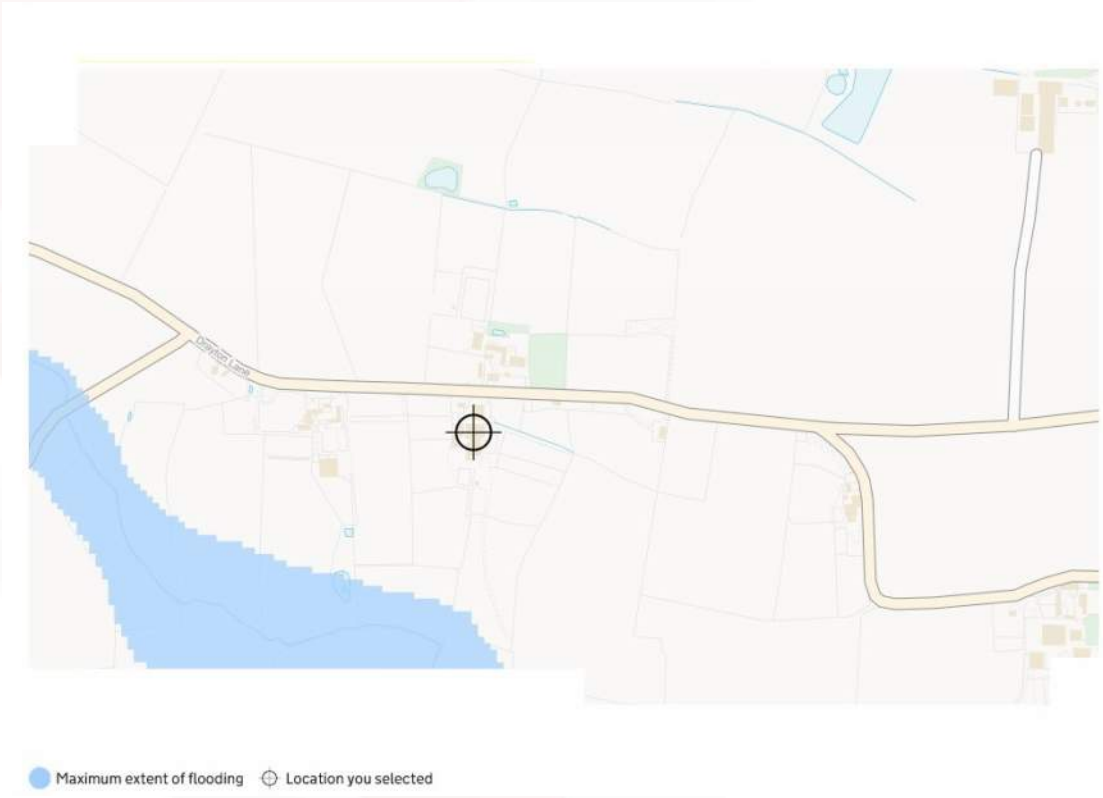


Figure 7: Environment Agency Reservoir Flood Map (Source: Environment Agency, 2020, GOV.UK)

3.6 Flooding from Sewers

3.6.1 Severn Trent do not provide information on flood risk from their assets. As discussed in Section 2.6, the sewers records (included in Appendix A) indicate that there are no sewers crossing the site.

4 FLOOD MITIGATION

4.1 Summary of Flood Risk

4.1.1 The risk of flooding from fluvial sources, surface water, sewers, artificial sources and reservoirs is considered to be very low and therefore it is recommended that mitigation measures are not necessary in this respect for the proposed development. However, there is a low chance of surface water flooding to the south east of the site where a car park is proposed. Careful consideration of the use of SuDS in this area will mitigate the issues most likely associated with the small "drain" in that area of the site running away to the east.

Source of Flood Risk	Predicted Flood Risk (AEP, %)	Interpreted Risk Classification	Justification
Fluvial	<0.1%	Very Low	As predicted by EA
Tidal	<0.1%	Very Low	As predicted by EA
Surface Water	0.1 – 1%	Low	As predicted by EA
Groundwater	N/A	Very Low	Ground Investigation
Artificial Sources	N/A	Very Low	As predicted by EA and engineering observation of sources on OS Maps
Sewer	N/A	Very Low	No sewers present

Table 3: Flood return periods and exceedance probabilities

5 SURFACE WATER DRAINAGE STRATEGY

5.1 Site Areas

The total site area is 1.05ha (10,500m²). Table 3.1 shows the estimated existing land cover areas. Table 3.2 gives the areas of potentially permeable and impermeable land cover and shows that impermeable areas could cover 80% of the site with permeable areas covering 20%.

Table 3.1 Existing Land Cover Areas

Land Cover	Area		Percentage of total site area
	m²	Ha	
Total impermeable area	6783	0.678	65%
Remaining permeable area	3717	0.372	35%

Table 3.2 Area of Potentially Impermeable & Permeable Land Cover

Land Cover	Area		Percentage of total site area
	m²	Ha	
Total impermeable area	8423	0.1842	80%
Remaining permeable area	2077	0.208	20%

5.2 Rate of Runoff Assessment

Full details of the calculations and the methodology for deriving the Peak Rate of Runoff are in included in Appendix D. A summary of the results is included in Table 3.3 below.

Table 3.3 Surface Water Rate of Runoff Results – Entire development

Peak Rate of Runoff (l/s)		
Event	Pre-Development Greenfield	Proposed Post-Development Restricted Greenfield
Q1	5.1	6.1
QBAR	6.1	6.1
Q10	9.2	6.1
Q30	12.2	6.1
Q100	15.1	6.1
Q100 + 30% CC	20.5	6.1

5.3 Surface Water Disposal

Surface water disposal has been considered in line with the hierarchy outlined in the SuDS manual. The approach considers infiltration drainage in preference to disposal to watercourse, in preference to discharge to sewer.

5.4 Surface Water Drainage Design Parameters

The surface water drainage system has been designed on the following basis using the modified rational method and a generated rainfall profile:

5.4.1 Climate Change

Projections of future climate change indicate that more frequent short-duration, high intensity rainfall and more frequent periods of long-duration rainfall are likely to occur over the next few decades in the UK. These future changes will have implications for river flooding and for local flash flooding. These factors will lead to increased and new risks of flooding within the lifetime of planned developments.

In February 2016, new climate change guidance issued by the Environment Agency came into effect outlining the anticipated changes in extreme rainfall intensity.

Table 3.4 shows anticipated changes in extreme rainfall intensity in small and urban catchments. Guidance states that for site-specific flood risk assessments and strategic flood risk assessments, both the central and upper end allowances should be assessed to understand the range of impacts. A climate change allowance of 30% has been selected for the purpose of drainage design based on the 100-year anticipated design life of the proposed development. This intermediate figure has been selected for conservative design. No properties are located immediately downstream of the site and therefore the site poses low risk to neighbouring property.

Table 3.4 Anticipated changes in Climate Change effects (%) over design life duration

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

5.4.2 Percentage Impermeability (PIMP)

The percentage impermeability (PIMP) for all impermeable areas is modelled as 100%. The entirety of the impermeable areas is therefore assumed to be positively drained.

5.4.3 Volumetric Runoff Coefficient (Cv)

The volumetric runoff coefficient describes the volume of surface water which runs off an impermeable surface following losses due to infiltration, depression storage, initial wetting and evaporation. The coefficient is dimensionless. Default industry standard volumetric runoff coefficients are 0.75 for summer and 0.84 for winter.

5.4.4 Rainfall Model

The calculations use the REFH2 unit hydrograph methodology in line with best practice as outlined in the SuDS manual. The calculations use the most up to date available catchment descriptors (2013) provided by the Centre for Ecology and Hydrology Flood Estimation Handbook web service.

5.4.5 Design Infiltration Rate

As stated in Section 2.6, infiltration is not feasible for this site.

5.5 Surface Water Drainage Proposals

Based on the site conditions, available surrounding water bodies and sewer assets, the following SuDS techniques are proposed:

- Traditional channel drains and gullies draining to a below ground drainage network with pipework and inspection chambers.
- Detention basin providing storage for restricted runoff by Hydrobrake device.

The SuDS have been sized to contain a future 1% AEP event of critical duration with climate change (30%) accounted for. Although much of the paving areas surrounding the gospel hall will not be positively drained, they have also been included with the drainage catchment areas for conservative design. The proposed surface water drainage layout is included in Appendix E.

It is proposed the entirety of the gospel halls roof runoff, paved runoff and surrounding access road is to be drained via rainwater downpipes, gullies and channel drains into a standalone surface water drainage network leading to a detention basin to the south east of the site where runoff will be restricted to 6.1l/s prior to being discharged towards the watercourse to the south of the site.

The development is currently a brownfield site and is deemed impermeable therefore disallowing permeable SuDS features other than the small amount of grasscrete/permeable paving surrounding the parking areas, which will be supplemented with a fin drain connecting to the drainage network. The site slopes down to the southern boundary therefore this is where the detention basin will be located.

The detention basin is to be 1.5m deep with a surrounding exceedance and service berm allowing for 480m³ of storage. The basin will have 1:3 side slopes and additional features such as sediment forebays and aquatic benches will be assessed post planning. Runoff will be restricted within the manhole chamber located immediately after the detention basin via a Hydrobrake device. Runoff at this location will be limited to Greenfield QBar (6.1l/s) and has been determined due to the discharge of runoff being to a small watercourse to the south of the site, therefore not over burdening the watercourse itself.

5.6 Designing for Local Drainage System Failure

In accordance with the general principles discussed in CIRIA Report C635 – Designing for Exceedance in Urban Drainage, the proposed surface water drainage, where practical, should be designed to ensure there is no increased risk of flooding to the buildings on the site or elsewhere as a result of extreme rainfall, lack of maintenance, blockages or other causes.

5.7 Blockage & Exceedance

The site drainage will be designed to store a 100-year design storm including a 30% allowance for climate change. The drainage systems will also provide capacity for lower probability (greater design storm events) which are not critical duration. Exceedance flows shall be retained on site within the drainage system as far as practical however for storms of a greater return period it may be necessary to pass forward more flow or spill flows. In this unlikely event, exceedance flows from the flow control chamber and detention basin would be routed down the existing fields towards the watercourse as per the current natural drainage method of the existing site.

5.8 Treatment Processes

Treatment of the surface water run-off from the main building will be via sediment traps within the gullies and sump units within the channel drains. The detention basin will also provide a high level of surface water treatment prior to any runoff discharging to the nearby watercourse.

6 CONCLUSIONS

6.1.1 The site is located within Flood Zone 1.

6.1.2 The proposed development is classed as a major development and according to the NPPF's PPG as a gospel hall the site is classed as less vulnerable to flood risk. Less vulnerable developments are deemed acceptable in Flood Zone 1.

6.1.3 The site is at very low risk of flooding from fluvial sources, tidal sources, groundwater, sewers and artificial sources.

6.1.4 The site is a low risk of surface water flooding within the south east corner of the site, located near an area labelled with a "drain". As explained in Section 3.3.3 and 3.3.4 the chances are this drain is an area which collects or transports surface water runoff in heavy periods of rainfall and potentially backs up due to lack of maintenance leading to a compromised capacity or blockage. Consideration to the remediation of this area must be taken during construction. This area is proposed for car parking so will not pose any risk of flooding to the proposed gospel hall.

- Surface water drainage for the site shall be drained via traditional methods of rainwater downpipes, gullies and channel drains, all leading to a private local drainage network. The network is to then pass through to a detention basin located to the south east of the site. The basin is to be 1.5m deep and has the capacity for 480m³ of storage. Flows have been restricted to 6.1l/s, although this is a brownfield site, it is proposed runoff is to discharge to a nearby watercourse to the south therefore, greenfield runoff rates (QBar) has been achieved to prevent over burden of the watercourse.
- The development proposals, levels and drainage have been carefully designed to ensure that the scheme will have no impact on any potential flooding issues downstream within the area as a result of extreme rainfall, lack of maintenance, blockages or other causes. The measures that will be implemented comprise additional flows allowed for adding 30% climate change to the 1% AEP and treatment/sediment control within the drainage network. Exceedance flows will be carefully managed and directed towards the existing watercourse as per natural drainage currently displays.

7 REFERENCES

[1] Ministry of Housing, Communities and Local Government, *National Planning Policy Framework*, July 2018.

[2] Ministry of Housing, Communities and Local Government, *Planning Practice Guidance to the National Planning Policy Framework*, September 2018. (Some parts of the guidance backdate)

[3] Defra/Environment Agency Portal, April 2020.

[4] British Geological Survey (BGS), GeoIndex Onshore, Superficial Deposits and Bedrock Geology, 1: 50,000.

[5] Land Information System (LANDIS)- Soilscapes viewer, January 2016.

[6] Environment Agency Groundwater Vulnerability Maps, Defra Magic Map, May 2013.

[7] Environment Agency Main River Map, April 2020.

[8] Severn Trent Sewer Records, July 2020.

[9] Centre for Ecology and Hydrology, *Flood Estimation Handbook, Web Service,* 2020.

[10] CIRIA, *The SUDS Manual*, Report C753, 2015.

[11] Marshall & Bayliss, 1994. *Flood Estimation for Small Catchments*, *Report No. 124 (IoH 124)*, Institute of Hydrology.

[12] Environment Agency Spatial Data Catalogue, WMS Links, January 2016.

[13] Institute of Hydrology, Flood Studies Supplementary Report No 14 – Review of Regional Growth Curves, August 1983.

[14] Institute of Hydrology, *Flood Studies Report, Volume 1, Hydrological Studies*, 1993.

[15] CIRIA, *Designing for Exceedance in Urban Drainage – good practice*, Report C635, London, 2006.

[16] HM Government The Building Regulations 2010, *Drainage and waste disposal approved document Part H*, 2015.

[17] DEFRA, *Sustainable Drainage Systems – Non-statutory technical standards for sustainable drainage systems,* March 2015.

APPENDIX A

SEWER RECORDS

Scale: 1:1250 | Date: 23/03/20 | Wastewater Plan A3

Data updated: 16/03/20 | Map Centre: 417764,300003 | Our Ref: 378119 - 4 | Powered by digdat

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

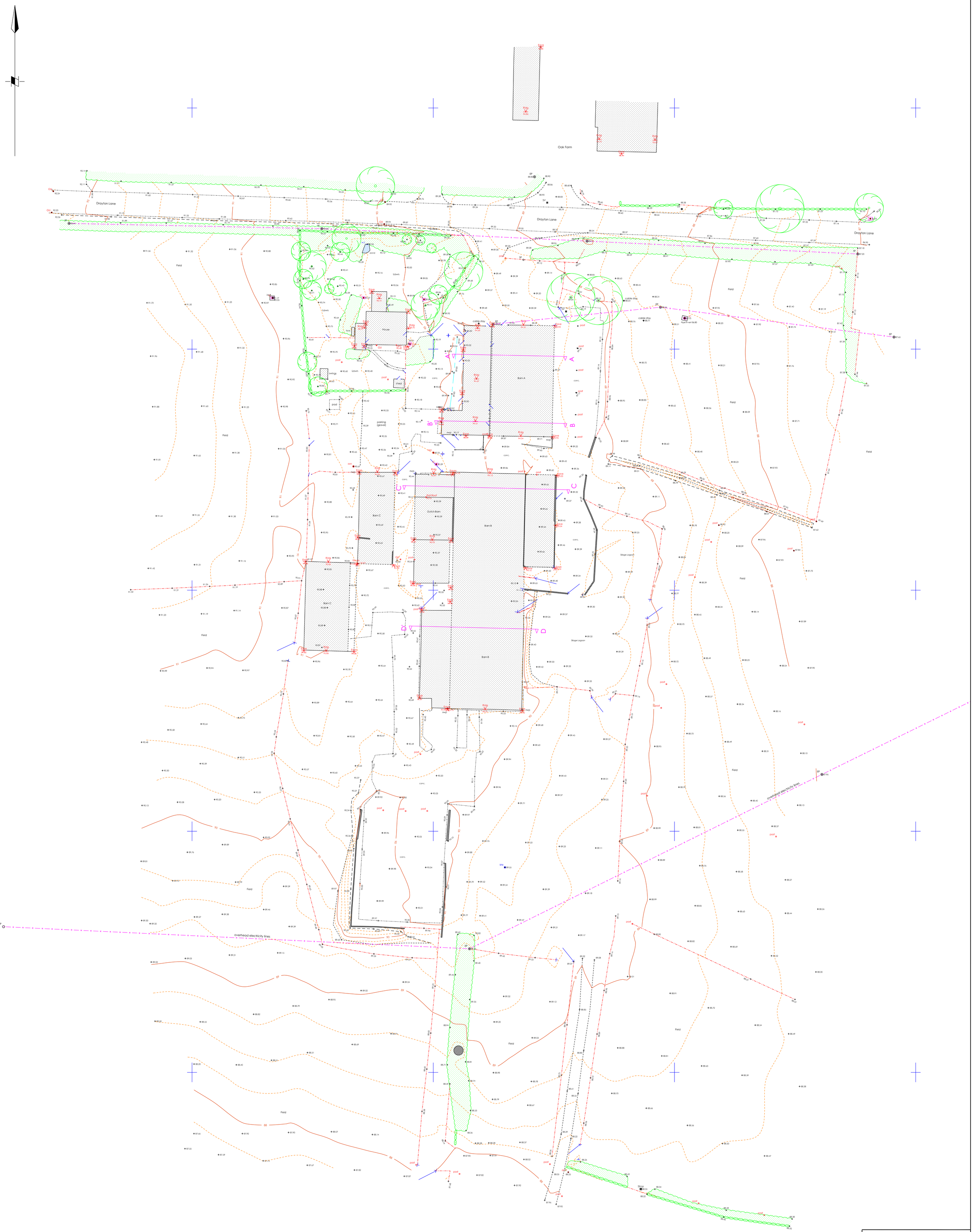
brian.mcmaster@national-one-call.co.uk

NOC/UTFTD011

SEVERN TRENT

APPENDIX B

TOPOGRAPHIC SURVEY



Survey Key:-

BO	Bollard
BB	Belisha Beacon
BT	BT Cover
CB	Telephone Control Box
CH	Coal Hole
CO	Unidentified Cover
Conc	Concrete
EP	Electricity Pole
FH	Fire Hydrant
FT	Face Profile Target
FW	Foul Water Drain Cover
GU	Drainage Gully Cover
GV	Gas Valve
Gas	Gas Cover
IC	Inspection Chamber Cover
LB	Letter Box
LP	Lamp Post
MC	Metal Drainage Channel
MH	Manhole Cover (round)
MP	Marker Post
Rwp	Rain Water Pipe
SV	Water Stop Valve
SW	Storm Water Drain Cover
TCB	Telephone Call Box
TL	Traffic Light
TP	Telegraph Pole
TV	Cable TV Cover
WM	Water Meter Cover

Some of these symbols may not appear on this drawing

STN 57.08	Survey Control Station
TP 154.87	Trial Pit
BH 154.87	Borehole
WL 154.87 21/01/10	Water Level (with date measured)
+ 154.87	Spot Level
154.87	Tree (spread to scale)

Linetypes

	Fenceline
	Electricity Transmission Line
	Hedge
	Rock Face
	Embankment Slope
10.00	Contour Lines
	Gas Pipeline
	Water Pipeline

Building Internals - Specific Codes

Ceil + 154.87	Structural Ceiling Level
F-Ce + 154.87	False / Suspended Ceiling Level
+ 154.87	Floor Level
usb + 154.87	Underside of Beam / Openings Level

Notes :-

Survey is tied to Ordnance Survey grid and level by GPS Smartnet

Contours where shown are at 0.25m intervals and highlighted at 1m intervals

BeaconLandSurveys
The Lodge
Greenhough Road
Lichfield
Staffs. WS13 7AU
Tel : 01543 417399
Mob: 07764 585084
email :- office@beacon-lichfield.co.uk

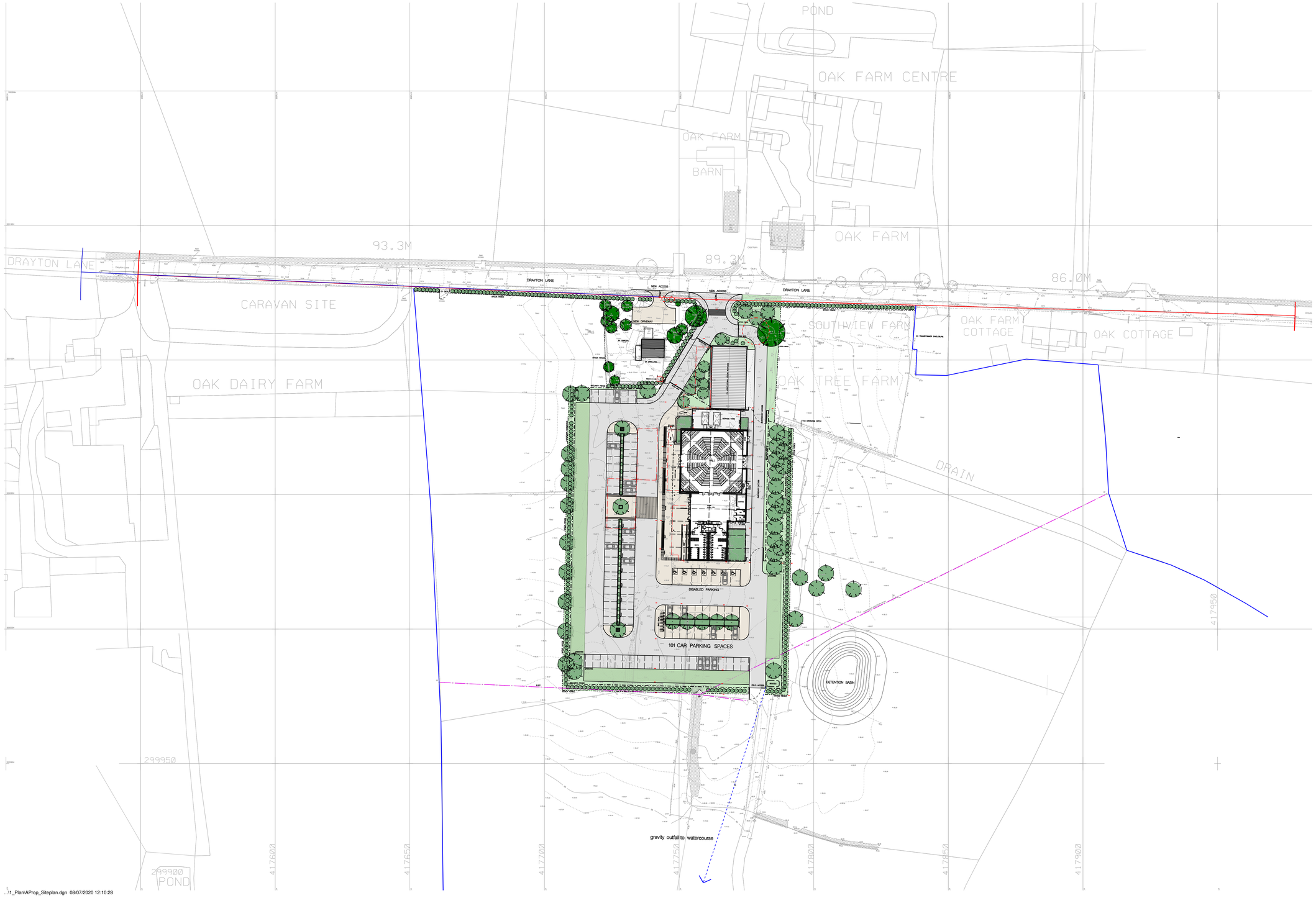
Project:
Oak Tree Farm
Drayton Bassett

Drawing:
Property Detail & Level Survey

Scales:	*Drawn/Sheet Size:*
1:250	mjs/A0
Date: March 2020	*Drawing No:* 20-035-01

APPENDIX C

ARCHITECTURAL DRAWINGS



...\1_Plan\APrep_Siteplan.dgn 08/07/2020 12:10:28

APPENDIX D

CALCULATIONS

THOMAS CONSULTING STRUCTURAL & CIVIL DESIGN ENGINEERS	Job	Oak Tree Farm	Job No.	L9434	Initial	JP
		Drayton Lane	Date	Jul-20	Checked	MJ
		Drayton Bassett	Page	1 of 4	Revision	Origional
	Title	Peak Rate of Run-Off Calculation				

Design Brief

The following peak rate of run-off calculations have been undertaken to determine changes in peak flow resulting from the development of a greenfield or brownfield site. These calculations are for the Peak Rate of Run-Off requirements only.

Baseline Information & References

The site area is less than 200ha and the Greenfield (pre-development) calculation has been undertaken in accordance with methodology described by Marshall & Bayliss, Institute of Hydrology, Report No. 124, Flood Estimation for Small

In addition, the following references have been used in the preparation of these calculations:

- Interim Code of Practice for Sustainable Drainage Systems (SUDS), CIRIA, 2004
- CIRIA, The SUDS Manual, Report C753, 2015
- Designing for Exceedance in Urban Drainage - Good Practice, CIRIA Report C635, 2006
- Flood Estimation Handbook (FEH)
- Flood Studies Report (FSR), Volume 1, Hydrological Studies, 1993
- Flood Studies Supplementary Report No 2 (FSSR2), The Estimation of Low Return Period Floods
- Flood Studies Supplementary Report No 14 (FSSR14), Review of Regional Growth Curves, 1983
- Planning Practice guidance of the National Planning Policy Framework

Proposed Land Use Changes

Changes to the existing site are as follows: Greenfield Site to Brownfield Site

Results Summary

Rate of Run-Off (l/s)			
Event	Greenfield		Proposed Restricted Post-Development Greenfield
Q1	5.1		6.1
QBAR	6.1		6.1
Q10	9.2		6.1
Q30	12.2		6.1
Q100	15.8		6.1
Q100 + 30% CC	20.5		6.1

THOMAS CONSULTING STRUCTURAL & CIVIL DESIGN ENGINEERS	Job	Oak Tree Farm	Job No.	L9434	Initial	JP
		Drayton Lane	Date	Jul-20	Checked	MJ
		Drayton Bassett	Page	2 of 4	Revision	Origional
	Title	Peak Rate of Run-Off Calculation				

SITE AREAS

Existing Impermeable & Permeable Land Cover

Total Site Area: **1.05** ha **10500** m²

Existing Impermeable & Permeable Land Cover

Land Cover	Area		Percentage of total site area
	m²	ha	
Total impermeable area	6783.0	0.678	65%
Remaining permeable area	3717.0	0.372	35%

Proposed Land Cover Areas

Land Cover	Area		Percentage of total site area
	m²	ha	
Impermeable Area	8423.0	0.842	80%
Permeable Area	2077.0	0.208	20%

Proposed Impermeable & Permeable Land Cover

Land Cover	Area		Percentage of total site area
	m²	ha	
Total impermeable area	8423.0	0.842	80%
Remaining permeable area	2077.0	0.208	20%

THOMAS CONSULTING STRUCTURAL & CIVIL DESIGN ENGINEERS	Job	Oak Tree Farm	Job No.	L9434	Initial	JP
		Drayton Lane	Date	Jul-20	Checked	MJ
		Drayton Bassett	Page	3 of 4	Revision	Origional
	Title	Peak Rate of Run-Off Calculation				

ESTIMATION OF QBAR (GREENFIELD RUNOFF RATE)

IoH 124 based on research on small catchments < 25 km2

Method is based on regression analysis of response times
using catchments from 0.9 to 22.9 km^2

$QBAR_{rural}$ is mean annual flood on rural catchment
$QBAR_{rural}$ depends on SOIL, SAAR and AREA most significantly

$QBAR_{rural} = 0.00108 \times AREA^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$

For SOIL refer to FSR Vol 1, Section 4.2.3 and 4.2.6 and IoH 124

Contributing watershed area

Area, A	=	500000	m^2	insert 50 ha for EA
	=	0.500	km^2	small catchment method
	=	50.000	ha	

SAAR = **660** mm From UKSuds website (point data)

Soil index based on soil type, SOIL $= \frac{(0.1S1+0.3S2+0.37S3+0.47S4+0.53S5)}{(S1+S2+S3+S4+S5)}$

Where: S1	=		%	UK Suds website provides a value of 4 based on the equivalent Host value. Ground investigation discovered the underlying soils to be entirely impermeable. Based on ground investigations the SOIL value has been altered to 5.
S2	=		%	
S3	=		%	
S4	=		%	
S5	=	**100**	%	
		100	%	
So, SOIL	=	**0.53**		

Note: for very small catchments it is far better to rely on local site investigation information.

$QBAR_{rural}$	=	0.292	m^3/s
	=	292.5	l/s

Small rural catchments less than 50 ha
The Environment Agency recommends that this method should be used for development sizes from 0 to 50 ha and should linearly interpolate the formula to 50 ha.

So, catchment size	=	**10500**	m^2	Excluding significant open space which would remain disconnected from the positive drainage system during flood events.
	=	0.011	km^2	
	=	1.050	ha	
$QBAR_{rural\ site}$	=	0.00614	m^3/s	
	=	**6.14**	l/s	

THOMAS CONSULTING STRUCTURAL & CIVIL DESIGN ENGINEERS	Job	Oak Tree Farm	Job No.	L9434	Initial	JP
		Drayton Lane	Date	Jul-20	Checked	MJ
		Drayton Bassett	Page	4 of 4	Revision	Origional
	Title	Peak Rate of Run-Off Calculation				

GREENFIELD RETURN PERIODS

QBAR can be factored by the UK FSR regional growth curves for return periods <2 years and for all other return periods to obtain peak flow estimates for required return periods.

These regional growth curves are constant throughout a region, whatever the catchment type and size.

See Table 2.39 for region curve ordinates
Use FSSR2 Growth Curves to estimate Qbar

Reference- Pg 173-FSR V.1, ch 2.6.2

Region = **4**

Use Figure A1.1 to determine region

GREENFIELD RETURN PERIOD FLOW RATES

Return Period	Ordinate	Q (l/s)
1	0.83	5.10
2	0.89	5.47
5	1.23	7.55
10	1.49	9.15
25	1.87	11.48
30	1.99	12.22
50	2.2	13.51
100	2.57	15.78
200	2.98	18.30
500	3.62	22.23
1000	4.2	25.79

Ordinate from FSSR2

Interpolation taken from Figure 24.2 (pg 515) SuDS Manual

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m^3)	Status
15 min Summer	9.264	0.764	6.0	191.4	O K
30 min Summer	9.438	0.938	6.0	250.2	O K
60 min Summer	9.593	1.093	6.0	307.4	O K
120 min Summer	9.719	1.219	6.0	357.9	O K
180 min Summer	9.773	1.273	6.0	380.5	O K
240 min Summer	9.798	1.298	6.0	391.1	O K
360 min Summer	9.811	1.311	6.0	396.8	O K
480 min Summer	9.803	1.303	6.0	393.5	O K
600 min Summer	9.785	1.285	6.0	385.6	O K
720 min Summer	9.767	1.267	6.0	377.8	O K
960 min Summer	9.730	1.230	6.0	362.3	O K
1440 min Summer	9.661	1.161	6.0	334.2	O K
2160 min Summer	9.561	1.061	6.0	295.3	O K
2880 min Summer	9.458	0.958	6.0	257.2	O K
4320 min Summer	9.217	0.717	6.0	176.6	O K
5760 min Summer	9.024	0.524	6.0	120.2	O K
7200 min Summer	8.880	0.380	6.0	82.5	O K
8640 min Summer	8.780	0.280	5.8	58.6	O K
10080 min Summer	8.714	0.214	5.5	43.7	O K
15 min Winter	9.337	0.837	6.0	215.2	O K
30 min Winter	9.524	1.024	6.0	281.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Discharge Volume (m^3)	Time-Peak (mins)
15 min Summer	125.476	0.0	197.0	26
30 min Summer	82.415	0.0	258.9	41
60 min Summer	51.576	0.0	325.2	70
120 min Summer	31.192	0.0	393.4	128
180 min Summer	22.936	0.0	433.9	186
240 min Summer	18.332	0.0	462.4	246
360 min Summer	13.310	0.0	503.6	364
480 min Summer	10.608	0.0	535.2	480
600 min Summer	8.890	0.0	560.6	556
720 min Summer	7.691	0.0	581.9	610
960 min Summer	6.115	0.0	616.8	734
1440 min Summer	4.420	0.0	668.3	1000
2160 min Summer	3.189	0.0	724.7	1412
2880 min Summer	2.527	0.0	765.8	1828
4320 min Summer	1.819	0.0	826.2	2556
5760 min Summer	1.438	0.0	871.9	3232
7200 min Summer	1.199	0.0	908.1	3896
8640 min Summer	1.032	0.0	938.3	4584
10080 min Summer	0.909	0.0	964.3	5248
15 min Winter	125.476	0.0	220.7	26
30 min Winter	82.415	0.0	289.9	40

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	9.691	1.191	6.0	346.2	O K
120 min Winter	9.830	1.330	6.0	405.0	O K
180 min Winter	9.892	1.392	6.0	432.5	O K
240 min Winter	9.922	1.422	6.0	446.5	Flood Risk
360 min Winter	9.945	1.445	6.0	456.8	Flood Risk
480 min Winter	9.945	1.445	6.0	456.9	Flood Risk
600 min Winter	9.932	1.432	6.0	450.9	Flood Risk
720 min Winter	9.912	1.412	6.0	441.6	Flood Risk
960 min Winter	9.866	1.366	6.0	421.1	O K
1440 min Winter	9.780	1.280	6.0	383.6	O K
2160 min Winter	9.642	1.142	6.0	326.8	O K
2880 min Winter	9.493	0.993	6.0	269.8	O K
4320 min Winter	9.122	0.622	6.0	147.9	O K
5760 min Winter	8.862	0.362	6.0	78.2	O K
7200 min Winter	8.720	0.220	5.6	44.9	O K
8640 min Winter	8.648	0.148	5.0	29.4	O K
10080 min Winter	8.621	0.121	4.5	23.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	51.576	0.0	364.3	68
120 min Winter	31.192	0.0	440.6	126
180 min Winter	22.936	0.0	486.0	184
240 min Winter	18.332	0.0	517.9	242
360 min Winter	13.310	0.0	564.0	356
480 min Winter	10.608	0.0	599.3	468
600 min Winter	8.890	0.0	627.8	576
720 min Winter	7.691	0.0	651.7	680
960 min Winter	6.115	0.0	690.7	772
1440 min Winter	4.420	0.0	748.2	1078
2160 min Winter	3.189	0.0	811.7	1540
2880 min Winter	2.527	0.0	857.7	1992
4320 min Winter	1.819	0.0	925.5	2680
5760 min Winter	1.438	0.0	976.6	3288
7200 min Winter	1.199	0.0	1017.1	3896
8640 min Winter	1.032	0.0	1051.0	4504
10080 min Winter	0.909	0.0	1080.1	5144

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.600	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.842

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.281	4	8	0.281	8	12	0.281

Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 8.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	187.0	0.500	270.0	1.000	367.0	1.500	478.0
0.250	227.0	0.750	317.0	1.250	420.0		

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0108-6100-1500-6100
Design Head (m)	1.500
Design Flow (l/s)	6.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	108
Invert Level (m)	8.500
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	6.1
Flush-Flo™	0.444	6.0
Kick-Flo®	0.911	4.8
Mean Flow over Head Range	-	5.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.7	1.200	5.5	3.000	8.4	7.000	12.6
0.200	5.4	1.400	5.9	3.500	9.0	7.500	13.0
0.300	5.9	1.600	6.3	4.000	9.6	8.000	13.4
0.400	6.0	1.800	6.6	4.500	10.2	8.500	13.8
0.500	6.0	2.000	6.9	5.000	10.7	9.000	14.2
0.600	5.9	2.200	7.3	5.500	11.2	9.500	14.5
0.800	5.5	2.400	7.6	6.000	11.7		
1.000	5.0	2.600	7.9	6.500	12.1		

APPENDIX E

PROPOSED CIVILS LAYOUT

DO NOT SCALE THIS DRAWING | A1

GENERAL NOTES:

1. Before construction commences, the setting out Engineer shall ensure that all setting out information is mutually compatible with all the drawings and documents provided by the designers. Where information is apparently contradictory or ambiguous, the design Engineer and/or the Architect is to be informed immediately. Thomas Consulting will accept no liability for setting out errors where work is constructed to incorrect information.

2. All drawings and documents are to be read in conjunction with one another, are mutually compatible and shall be read as such. All documents shall be checked to ensure that they are compatible by the contractor before construction commences. In the event of apparent ambiguity or contradiction the engineer and/or architect shall be notified immediately. Thomas Consulting accept no liability in the event of not being so notified and where construction work has commenced.

3. In accordance with CDM regulations 2015 this drawing has been prepared with due attention to identifying any unusual design hazards that may exist. Unusual design hazards are hazards that a reasonably competent contractor, experienced in this type of work may not be expected to identify. In dealing with unusual design hazards we have adopted the "ERIC" principle and where possible eliminated (E) the hazard at design stage, if it has not been possible to eliminate the hazard we have endeavoured to reduce (R) it. Where it has not been possible to eliminate these hazards, the hazard is noted on the drawing with appropriate information (I) in order that the hazard can be controlled (C) during construction. It is the contractor's responsibility to fully acquaint themselves with all construction drawings before commencing construction and if in doubt about any matter to ask for clarification from the designer.

4. All drawings issued electronically for this scheme are provided for the sole purpose of assisting the design, procurement or construction of the structures for which Thomas Consulting have been appointed as Design Engineers/Consultants. They may not be used for any other purpose, nor may they be amended, copied, redistributed or issued to third parties without the written agreement of Thomas Consulting. All drawings remain under copyright to, and the intellectual property of, Thomas Consulting. Upon completion of the project, all drawings are to be deleted from your computer systems and all other electronic copies destroyed. Where electronic copies of final drawings are to be issued, these will be provided in a digital only format by Thomas Consulting (no other copies may be retained). By opening and using this drawing, it is assumed that you agree to abide by these Terms and Conditions.

5. Unless expressly agreed with a director of Thomas Consulting Ltd, for the purposes of the CDM regulations 2015 Thomas Consulting are not the Principal Designer. The client has been advised that they are required to appoint a Principal Designer. For further information see http://www.hse.gov.uk/.

REVISIONS

REV	DATE	DESCRIPTION	DRAWN BY	CHECKED BY
A	15.07.20	Threshold drainage added and slight amendment to car park drainage layout	JP	MJ

DRAWING STATUS:
FOR BUILDING REGULATION APPROVAL

THOMAS CONSULTING
STRUCTURAL & CIVIL DESIGN ENGINEERS
*Offices in Chorley, **Lancaster** & Shrewsbury*
Tel: 01524 846022
e-mail: info@thomasconsulting.co.uk

CLIENT:
GROSVENOR GOSPEL HALL TRUST

PROJECT:
OAK TREE FARM
DRAYTON LANE
DRAYTON BASSETT

DRAWING TITLE:
PROPOSED SURFACE WATER DRAINAGE LAYOUT PLAN

DATE CREATED:	DRAWING SCALE:	DRAWN BY:	CHECKED BY:	QA CATEGORY:
06/07/20	1:250	JP	MJ	1

DRAWING REF: TC / L9434 / 20 / 100 | REV: A

Detention Basin
1:3 Slopes
480m³ Storage
1.5m Deep
Ciria SuDS Manual C753 to be addressed during the detailed design stages.

Surface water runoff to combine with treated foul water effluent from Biodisc. Gravity fed to watercourse where Althon headwall or similar approved is required. Specification and detailed design required post-planning.

Hydrobrake Flow Control
SHE-0108-6100-1500-6100
Design Head: 1.5m
Design Flow (l/s): 6.1
108ø Orifice
150ø Outfall Pipe
1200ø Minimum Manhole

KEY

- 450 x 450mm Gully Drain (150ø Outfall)
- ACO MultiDrain Channel Drain or similar approved. Heel guard slotted grating required (C250 Loading)
- ACO MultiDrain Channel Drain or similar approved. Standard slotted grating required. (C250 & A15 Loading)
- Polypropylene Inspection Chamber (450-600ø) with D400 manhole lid
- Pre-Cast Concrete Manhole Chamber (1200-1500ø) with D400 manhole lid
- ACO MultiDrain Channel Drain or similar approved. Brick slot required (A15 Loading)
- High Density Polyethylene Pipe (100-300ø) falls and final sizes to be designed post-planning
- Althon Headwall (1x 300ø inlet & 1x 150ø outlet) to be deigned and specified post-planning
- 100ø Fin Drain Polypipe Linflex or similar approved. Depth to be confirmed post-planning

NOTES

- Detailed network model to be produced and refined post-planning.
- Foul drainage provided/designed by others.
- Details of Detention Basin and Hydrobrake can be found in the MicroDrainage Source Control calculations.
- Treatment to be provided with grasscrete and sumps in gully pots and channel drains. During the detailed design stages the detention basin will be designed in line with the CIRIA SuDS Manual, applying the relevant treatment and sediment controls.
- Some annotation such as manholes and gullies have be scaled up for reference at planning.
- RWP pipes to be connected to network. Downpipes located post-planning.