William Stukeley Church of England Primary School

Drainage Strategy

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1.0 Introduction

1.1 This Drainage Strategy is provided as part of a Planning application for the William Stukeley Church of England Primary School redevelopment project.

1.2 The purpose of this strategy document is to outline the proposals for draining the foul and surface water associated with the new development.

1.3 This document should be read in conjunction with all other documentation provided as part of this application.

2.0 Site Description

2.1 William Stukeley Church of England Primary School is an existing primary school located off Spalding Road in Holbeach. The school site is bounded to the north by the grounds which previously formed part of the site of Stukeley Hall (demolished in 1994), to the east and west by residential properties and to the south by Patchett Lodge, an Elderly Persons Home.

2.1.1 Site Address: William Stukeley CE (VA) Primary School, Spalding Road, Holbeach, Spalding, PE12 7HG
2.1.2 OS Grid Reference: E: 535620, N: 324780
2.1.3 National Grid Reference: TF 35620 24780

2.2 The site comprises an unadopted access road off Spalding Road (B1515) with a roundabout/turning point, landscaped public park with limited hard landscaping paths in the north, an informal public car parking area to the west for visitors to the park, two formal car parking areas for the school to the west of the school buildings, grassed playing fields in the south (with a small hardstanding games area to the south-west), a Listed walled garden (remnant of the former Stukeley Hall), main school building and associated hardstanding areas in the centre of the site. Within the site grounds there is a small parcel of land that is not associated with the school site and noted to be 'Private Property'. Access to these two residential properties is made via Stukeley Hall Drive to the west of the site. The red line shown in Figure 1.0 below identifies the approximate site boundary to the existing school site. The total site area within the red line boundary is 3.26ha.



Figure 1.0 – Areal image of existing school site taken from Google Maps.

2.3 The site is located within the Holbeach Conservation Area as designated under Section 69/70 of the Town and Country Listed Buildings and Conservation Areas Act 1990, reference: CA09. Tree Preservation Order made in respect of trees at Stukeley Hall Town and Country Planning Act 1971 Section S60, reference: HOLBEACH TPO No10 1986, is also applicable. Reference should be made to the Architectural documentation and arboricultural surveys for further information relating to these items.

2.4 A topographical survey of the site was undertaken by Tower Surveys Associates, refer to drawings TSA-21-1327/201-202, dated October 2021, within the Planning submission documentation.

The site topography is relatively flat, generally sloping upwards from the south-west corner of the site (lowest level 3.12m AOD) to the north-east corner of the site (highest level at 4.38m AOD). There are slight undulations in the ground profile levels across the site owing to local landscaping depressions.

The external hardstanding areas to the perimeter of the school building at typically at 3.93m AOD, with existing finished floor level (FFL) at 4.13m AOD.

There is a small area of elevated topography in the east of the park, near Back Lane, to an area of stockpiled material upon which vegetation and trees have grown. Historic records indicate an air raid shelter within this area.

2.5 A utility search was undertaken by Tower Surveys Associates, refer to report TSA-21-1327, dated October 2021, within the Planning submission documentation.

2.6 A buried services and CCTV drainage condition survey of the site was undertaken by Tower Surveys Associates, refer to drawings TSA-21-1327/101-102, dated October 2021, within the Planning submission documentation. These surveys were extended to the west of the site, along Spalding Road, to trace the surface water sewer within the highway, refer to drawings TSA-21-1327/103-104, dated October 2022, within the Planning submission documentation.

2.7 A partial measured building survey of the existing school that is being extended was undertaken by Fosse Surveying, refer to drawing 1956, dated November 2022, within the Planning submission documentation.

3.0 Project Description

3.1 This project consists of several building extensions, internal refurbishment, and the extension to an existing hardstanding games area. The works are to be undertaken over two phases:

- Phase 1 works to include the extension to the north-east of the school building to increase existing staff facilities, alteration to existing toilets, new build plant room, extension to the hall including chair store, a single classroom extension to the south-east (adjacent the existing plant room which is to be repurposed as a store), and a 10m x 18m extension to the west of an existing hardstanding games area.

- Phase 2 works are to include a three-classroom extension to the south-east corner of the school building.

3.2 The two phases of the building extensions are shown in Figure 2.0 below.

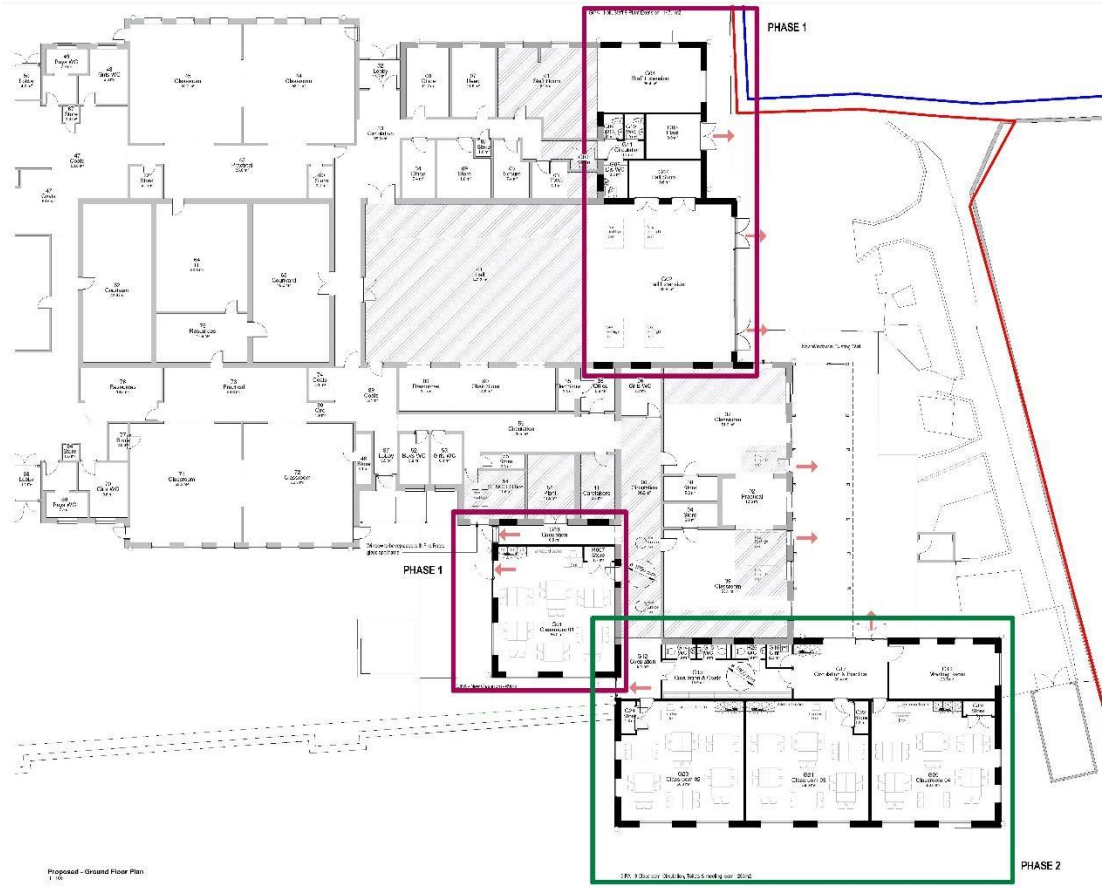


Figure 2.0 – Proposed GA Plan of William Stukeley CEP School with Phase 1 areas (red) and Phase 2 area (green)

4.0 Existing Ground Conditions

4.1 British Geological Survey (BGS) online viewer (bgs.ac.uk/viewer) indicates that the site is underlain by superficial Tidal Flat Deposits comprising clay and silt. Furthermore, the site is mapped as being underlain by bedrock of the West Walton Formation comprising mudstone and siltstone.

4.2 A previous limited Phase 2 site investigation by Delta Simons, dated 2018, included 2 No. dynamic sampler boreholes (DS101—DS102) and a cable percussion borehole (CP101) located around the proposed single classroom extension to the north-west of the school building.

The ground conditions encountered comprised the following generalised sequence:

- MADE GROUND: Grass over light brown slightly sandy gravelly SILT, with flint, cobbles and brick from ground level to a depth of 1.75m bgl (DS101-102); and sandy, slightly gravelly CLAY from ground level to 0.4m bgl, overlying sandy, slightly gravelly silt to 1.1m bgl (CP101);
- Firm brown sandy SILT (TIDAL FLAT DEPOSITS) to a depth of 4.5m bgl; and
- Medium dense brown silty fine SAND (TIDAL FLAT DEPOSITS) to a maximum unproven depth of 7.95m bgl.

The commentary of the recorded strata was as follows:

- CP101 was terminated at 7.95 m bgl due to blowing sands impeding progression below this depth.
- Groundwater was encountered in DS101 at 2.4m bgl during drilling, and in CP101 at 4.5m bgl. During return monitoring groundwater levels were recorded as 1.26m and 1.44m bgl.
- Drainage was noted on site and a drainage pipe was encountered in the base of the hand pit for DS102. A soakaway chamber was located in the area of the proposed extension. A BRE 365 soakage test was undertaken. For new soakaway features at the Site, it was recommended an [average] infiltration rate of 4.32x10-06 m/s was recommended for design purposes.
- Based on the findings of the report the updated CSM pollutant linkage assessment found all linkages to be ‘Very Low Risk’ to ‘Low Risk’.
- The presence of weak bearing strata and variable groundwater levels are noted.

The report also notes the site overlies Unproductive Strata Aquifers with respect to the superficial (Tidal Flat Deposits) and bedrock (West Walton Formation) geology. The site is not located within a Source Protection Zone.

4.3 A further intrusive site investigation was commissioned by Lindum BMS to undertake sampling and infiltration testing within the current development area. Refer to Grange Geo report R22126/R001, dated November 2022, included within the Planning submission documentation. The logs from the intrusive testing identify a similar ground profile of Made Ground/Topsoil over Tidal Flat Deposits as reported in the limited Phase 2 site investigation by Delta Simons, dated 2018.

4.4 Groundwater strikes were encountered during the fieldwork phase in each of the excavations (excluding foundation inspection pits) undertaken during the site investigation, at depths of between 1.4m and 2.3m bgl.

Four weekly groundwater monitoring visits were undertaken following completion of the fieldwork, and a period of well stabilisation. During each visit, the standpipes were found to be dry, however the well base were found to be significantly shallower than the original install depth (2.18m bgl in WS1 and 2.28m bgl in WS2), potentially indicative of rapid silt ingress.

4.5 Two infiltration tests have been undertaken in accordance with BRE 365 within Trail Pits SA1 and SA2, to the west of the site near the grassed playing field entrance off Stukeley Hall Drive, at a depth of 1.5m and 1.6m bgl respectively within the Tidal Flat Deposits (Cohesive Component). Groundwater strikes were noted at the base of each excavation. Over the duration of both tests the required intercept failed to be reached and were therefore considered not to have been successful.

4.6 Two additional infiltration tests to BRE 365 were undertaken in the areas of the proposed hardstanding games extension and to the south-east of the site where surface water infiltration drainage from the building and hardstanding areas is to be considered, refer to Lindum BMS William Stukeley Primary School Infiltration Testing Report, dated January 2023, within the Planning submission documentation. The infiltration test to the hardstanding games extension provided a positive result, with the slowest infiltration rate of 1.99 $x10^{-5}$ m/s recorded. Over the duration of the test to the south-east corner of the site, the required intercept failed to be reached and were therefore considered not to have been successful.

5.0 Existing Sewer Infrastructure

5.1 The local foul sewerage undertaker for the Holbeach area is Anglian Water. We have been provided with a copy of the Anglian Water Wastewater Plan, a copy of which can be found in Appendix A.

5.2 The drawing identifies a 225mm dia foul water sewer heading north along Stukeley Hall Drive that connects to a 300mm dia sewer at Anglian Water manhole ref: 5903, which then heads in an easterly direction along Spalding Road.

5.3 A 150mm dia foul watstewater pipe serving the school and the two private properties connects at Anglian Water manhole ref: 5701 within Stukeley Hall Drive.

5.4 A 150mm dia surface water sewer in Spalding Road is noted on the asset mapping provided by LCC Highways. Further to discussions with LCC Highways department, it was established that the highway and adjacent land historically drained to an open ditch to the southern edge of the road with an assumed outfall to an Internal Drainage Board asset near the junction with Langwith Drive. This watercourse became 'piped in' as part of the residential development of the area however is considered by LCC Highways to remain as part of the land drainage system. Refer to Figures 3.0 and 3.1.

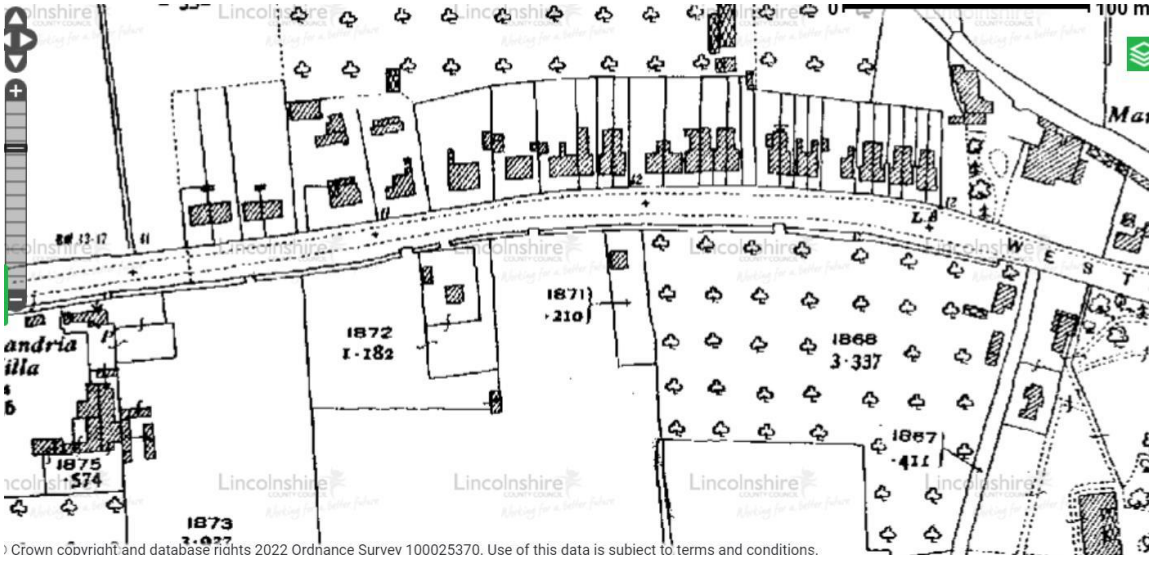


Figure 3.0 – Extract from 1905 Ordnance Survey mapping showing open ditch to south of highway.



Figure 3.1 – Extract from LCC Highways asset mapping for piped in watercourse.

5.5 The piped in surface water sewer along Spalding Road was surveyed by Tower Surveys Associates, refer to drawings TSA-21-1327/103-104, dated October 2022, within the Planning submission documentation. This survey confirmed that the sewer flows in a westerly direction and positively outfalls to the Internal Drainage Board managed F67 Langwith Drive – Pipeline DRN197P6702, connecting at Manhole D in the front garden of No. 51 Spalding Road. Refer to the Internal Drainage Board asset plan included in Appendix C.

6.0 Existing Site Drainage

6.1 A buried services and CCTV drainage condition survey of the site was undertaken by Tower Surveys Associates, refer to drawings TSA-21-1327/101-102, dated October 2021, within the Planning submission documentation.

6.2 The CCTV survey identifies a separate foul and surface water system at the site.

6.3 The surface water from the roofs of the existing buildings and from the hard landscaping is collected via a series of rainwater pipes and gullies and is carried by gravity through a network of pipes and manhole soakaways located to the north, west and south of the school building. The drainage condition survey was unable to confirm the details and extents of the soakaways, however reported multiple instances of ingress of tree roots and silting up of the system.

6.4 The existing soakaways are assumed to have been constructed of traditional stone filled excavations with no provision for access to undertake maintenance. A long stone filled trench soakaway to the south of the playground area is noted, which may extend under the footprint of the proposed Phase 2 three-classroom extension. The original soakaways will need to be replaced when they are no longer able to function as required, owing to the reported silting up and lack of access for maintenance.

6.5 The new soakaway to the north-west of the school building associated with the single classroom extension constructed in 2018 is assumed to have access provision, following general SuDS requirements at the time.

6.6 The original school building was built in 1994 and subsequently extended in 2000, 2002 and 2018, however anecdotal drainage plans for the site indicate that the capacity of the original drainage network has not been increased, nor developed in line with SuDS requirements for more recent developments, to cater for the increased impermeable building and external hard surfaced catchment areas. As such, it is considered likely that any residual capacity within the original drainage network, typically taken as 10% for urban creep allowance has previously been exceeded.

6.7 As such, Lincolnshire County Council (LCC) have instructed that the surface water drainage design proposals for the new development should also incorporate remedial works to accept the flows generated from the majority of the existing building and hardstanding catchment areas. This is discussed further in Section 8.0.

6.8 The foul wastewater network to the north, south and west of the existing school building is predominantly a gravity piped drainage system, however a small foul pumping station is noted to serve the rooms to the east of the school. The below ground foul pumping chamber is currently located external to the current hall and will need to be replaced to accommodate the proposed Phase 1 building extension works to the staff room, toilets and hall. This is discussed further in Section 8.0.

6.9 The foul wastewater network from the existing toilets near the Phase 1 single classroom extension is a gravity piped drainage system. These toilets are to be removed in Phase 2 to form an access corridor to the new extension with the toilet provision being relocated within the new three-classroom extension. The foul wastewater from the relocated toilets and new classroom sinks will be drained to a new, additional separate foul pumping chamber. This is discussed further in Section 8.0.

6.10 The CCTV output summary document describes the overall condition of the existing foul drainage network to be in reasonable condition considering its age.

7.0 Flood Risk Assessment

7.1 A Flood Risk Assessment (FRA) has been produced by Lincs Design Consultancy, report status Draft, dated November 2022. This report is contained within the Planning submission documentation.

7.2 The Environment Agency flood map for planning identifies the site as being spilt between Flood Zone 2 and Flood Zone 3, see Figure 4.0. The existing school building is located within Flood Zone 2.

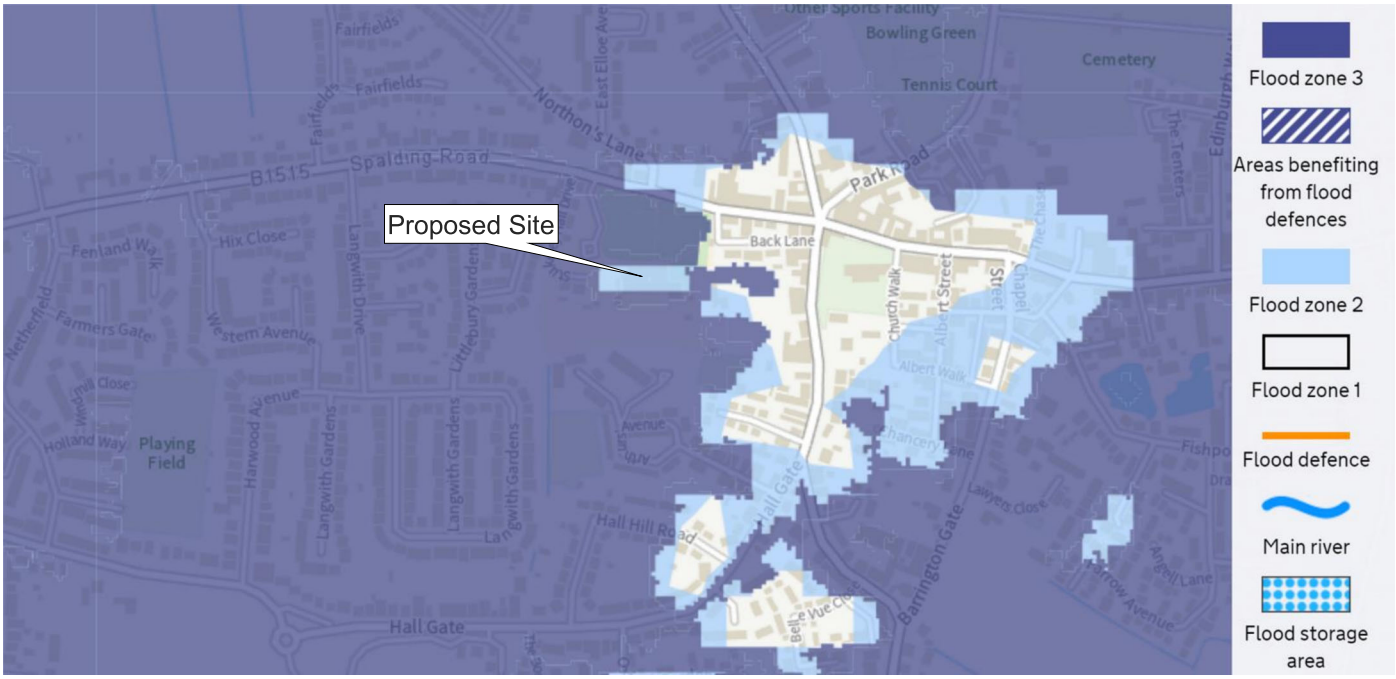


Figure 4.0 – Extract from the EA flood map for planning showing the site located within Flood Zone 2 and 3, however the building is located only within Flood Zone 2

7.3 The FRA advises that applications for minor developments should not be subject to the Sequential and Exception tests. The potential sources of flooding affecting the development site were identified as tidal from the North Sea, located 8 miles east of the site.

7.4 The Flood Maps show that the site could be affected by a breach of the sea defences in the future. The hazard maps show that the proposed Phase 1 single classroom extension and the staff room and hall extension are located outside of the hazard area. The Phase 2 three-classroom extension is partly located within the 0 – 0.25m flooding depth for the 0.1% breach event. The report concludes that any impact of damage to the proposed Phase 2 new build can be foreseen and mitigated against by relatively simple design and construction techniques. The building should be constructed using materials which are flood resilient in line with government publications.

7.5 As this site is in an area that can receive flood warnings from the Environment Agency Floodline Warning Direct system (www.gov.uk/sign-up-for-flood-warnings), it is recommended that the school contact the Environment Agency's Floodline to register the property to receive advance flood warnings, if not already activated. The Environment Agency aim to issue a 'severe flood warning' approximately 2 hours before existing defences are overtopped.

7.6 The FRA report demonstrates the proposed development is compliant with the requirements of the National Planning Policy Framework, and it is considered that planning permission should not be refused on flood risk grounds.

7.7 Infiltration testing has been carried out but the result of this deemed buried soakways to be unfeasible.

7.8 SuDS features have been included within the surface water drainage design including:

- Porous surfacing and construction build-up to the new hardstanding games area extension.
- Porous surfacing with cell-web tree root protection system to the Phase 1 eastern pedestrian paths.
- Below ground storage within the piped network, attenuation tanks and the use of a surface water pumping chamber as a flow control device to limit the discharge off site to a surface water sewer and outfall to an Internal Drainage Board managed watercourse.

8.0 Proposed Site Drainage

8.1 We have submitted a pre-development enquiry to LCC Highways and a copy of their response can be found in Appendix B.

8.2 We have submitted a pre-development enquiry to the Lead Local Flood Authority and are awaiting their response. A copy of the enquiry can be found in Appendix B. As the site is in Flood Zones 2 and 3, a Flood Risk Assessment has been carried out to support a Planning application.

8.3 We have submitted a pre-development enquiry to the Internal Drainage Board and a copy of their response can be found in Appendix C.

8.4 The drainage proposals can be seen on the drawings located within Appendix D. Drainage calculations associated with the design can be found within Appendix E.

8.5 The existing surface water drainage network to the east and south-east corner of the existing school buildings that drains to the assumed linear soakaway to the south of the playground will need to be amended as part of the development for the Phase 1 and Phase 2 building extensions.

8.6 The existing soakaways are assumed to have been constructed from unlined traditional stone filled excavations with no provision for access to undertake maintenance. A long stone filled trench soakaway to the south of the playground area is noted, which may extend under the footprint of the proposed Phase 2 three-classroom extension. The original soakaways will need to be replaced when they are no longer able to function as required.

8.7 LCC have instructed that the surface water drainage design proposals for the new development should also incorporate remedial works to accept the flows generated from the majority of the existing building and playground hardstanding catchment areas.

8.8 The surface water catchment area associated with the new development (1,200m²) is highlighted in green on Figure 5.0 overleaf, and the surface water catchment area from the majority of the existing building (775m²) and playground hardstanding (1,150m²) are highlighted in brown.

8.9 Whilst the CCTV drainage condition survey reported heavy silting of the outfall pipes discharging to the long stone filled trench soakaway located to the south of the playground area, it is noted that this drainage feature seems to be preforming satisfactorily with no indications of surface level breaching. As such, and to maintain the ecological balance to a row of established trees along the line of the linear soakaway, the existing yard gullies are to be retained although a series of new gullies are to be provided which will connected to the new drainage system. If in the future the existing linear soakaway should fail to perform satisfactorily due to long term silting, excess water at the surface will be collected by the new gullies and discharged from site via the new surface water system.

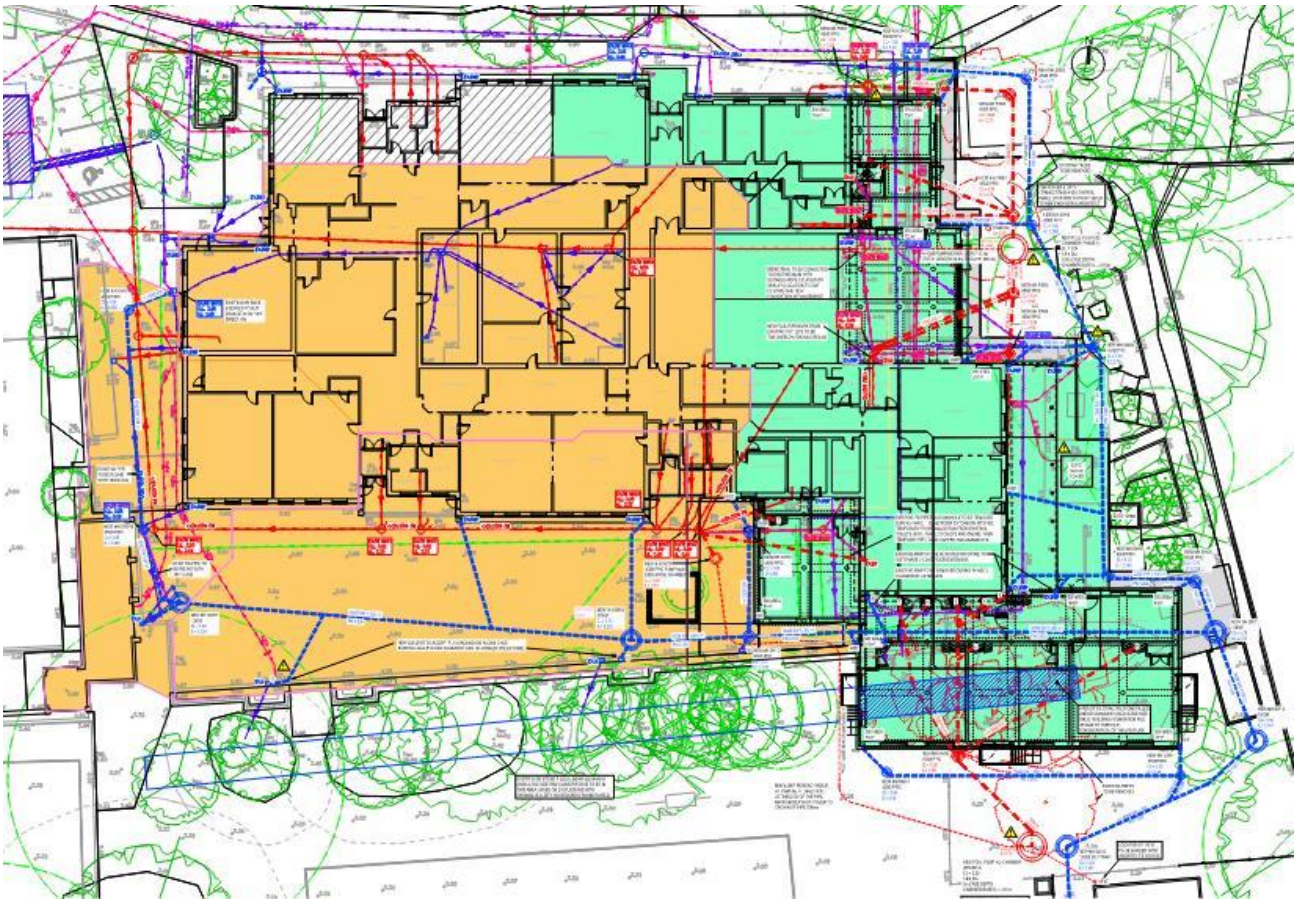


Figure 5.0 – Surface water catchment areas indicated

8.10 The new surface water below ground drainage networks have been designed to store all attenuated waters, up to the 1% AEP + climate change allowance, without surface flooding.

8.11 Climate change allowances have been derived assuming an epoch of 2070 and 3.3%AEP (+25%) and 1%AEP (+25%), as shown in Figure 6.0 below.

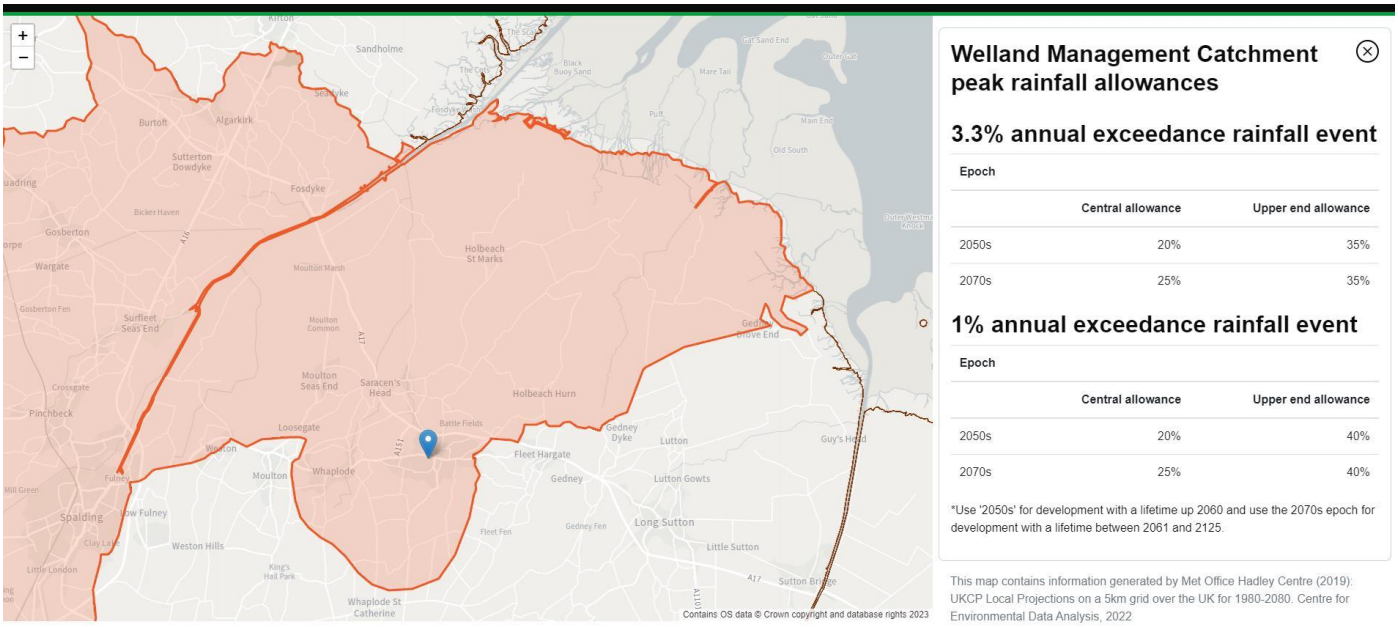


Figure 6.0 – Peak river flow climate change allowances by management catchment Gov.UK website

8.12 In accordance with the SuDS hierarchy, infiltration drainage should be adopted on sites where this is possible. Infiltration tests have been undertaken to the south-east corner of the development site which returned unfavourable results owing to the soil type and high groundwater levels. The next favoured SuDS option is to consider draining to a watercourse. As such, the drainage strategy is based upon attenuating surface water on site before discharging via a pumped system, at a reasonable and restricted rate of 2 l/s, to the surface water sewer within Spalding Road which is under riparian ownership. The pass-forward flows which discharge to the Internal Drainage Board managed F67 Langwith Drive – Pipeline DRN197P6702, connecting at Manhole D in the front garden of No. 51 Spalding Road.

8.13 Infiltration testing at shallow depth to the new hardstanding games area extension was reported to be favourable. A porous asphalt concrete surfacing and voided granular construction build-up has been proposed. A maximum water level of 118mm within the 450m depth of porous construction may be expected for the 1%AEP (+25%) storm event.

8.14 Porous surfacing with cell-web tree root protection system to the Phase 1 eastern pedestrian paths has been proposed in accordance with arboriculturist recommendations.

8.15 The existing below ground foul pumping chamber is located external to the current hall and will need to be replaced to accommodate the Phase 1 building extension works to the staff room, toilets and hall. The new pumping chamber will need to comply with Building Regulations Part H clause 2.39, i.e. it is required to provide 24 hours storage in the case of a power outage. Owing to school staff and students' occupation being limited to a daily attendance or contracted working hours (say, max 8 hours per day), the average water consumption and disposal rate for private pumped drainage will be taken as a minimum of 50 litres per person per day. A minimum storage volume of 5,500 litres below lowest incoming pipe invert into Foul Pump Chamber (Phase 1) will be required for an occupancy level of 110 persons, split as follows:

Students (2 Exst. Classrooms + New Classroom (Girls WC only, Boys to use Exst. WCs))	45
Full Time Equivalent Staff	50
Visitors	15

The new pumped main is to be connected to the existing main with a suitable MDPE coupler near the location of the previous pumping chamber,

8.16 The foul wastewater from the existing toilet block near the Phase 1 single classroom extension is a gravity piped drainage system. These toilets are to be removed in Phase 2 to form an access corridor to the new extension, with the toilet provision being replaced within the new three-classroom extension. The foul wastewater from the toilets and new classroom sinks will be drained to an additional foul pumping chamber. Similar to the above calculation, a minimum storage volume of 4,500 litres below lowest incoming pipe invert into Foul Pump Chamber (Phase 2) will be required for an occupancy level of 90 persons, split as follows:

Students (Phase 2 Classrooms)	90

The new pumped main is to discharge to a new receiving chamber with gravity flows before outfalling to the existing manhole EX.FW MH27. The discharge rate is to be set at a similar rate, as reasonably practicable, to the existing flows from the toilets that are to be removed to provide access to the Phase 2 three-classroom extension.

8.17 Dewatering of excavations for the installation of drainage infrastructure such as pumping chambers and attenuation tanks may be required to artificially lower groundwater levels. These temporary works are to be provided by a suitably qualified engineer.

9.0 Maintenance

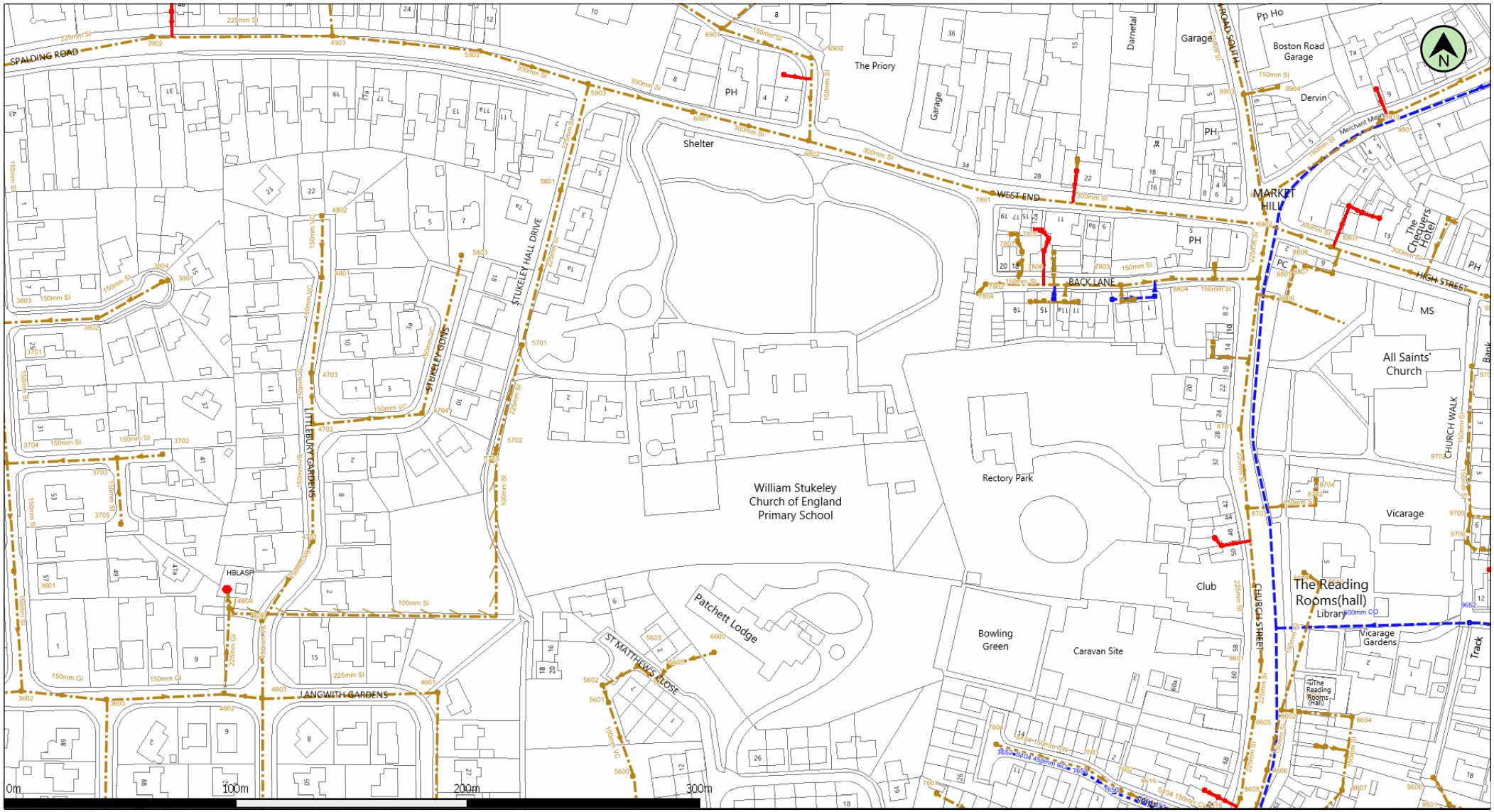
This section provides information in relation to the construction and ongoing management and maintenance of the new foul and surface water below ground drainage systems.

9.1 The new elements of the drainage system will be constructed as part of the construction process and on completion will be jetted. A CCTV camera survey of the new below ground network will be undertaken and provided to the client.

9.2 The buildings and associated external areas will remain private and will be the responsibility of the school to maintain.

9.3 Operation and Maintenance requirements are presented on drawing 36222-DBS-00-XX-DR-C-0005. This drawing and associated manufacturers literature are to be included in the O&M manual at project handover.

Appendix A – Anglian Water Sewer Record Drawing



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Date: 14/02/20 Scale: 1:2317 Map Centre: 535630,324770 Data updated: 03/01/20

Wastewater Plan A4

This plan is provided by Anglian Water pursuant its obligations under the Water Industry Act 1991 sections 198 or 199. It must be used in conjunction with any search results attached. The information on this plan is based on data currently recorded but position must be regarded as approximate. Service pipes, private sewers and drains are generally not shown. Users of this map are strongly advised to commission their own survey of the area shown on the plan before carrying out any works. The actual position of all apparatus MUST be established by trial holes. No liability whatsoever, including liability for negligence, is accepted by Anglian Water for any error or inaccuracy or omission, including the failure to accurately record, or record at all, the location of any water main, discharge pipe, sewer or disposal main or any item of apparatus. This information is valid for the date printed. This plan is produced by Anglian Water Services Limited (c) Crown copyright and database rights 2020 Ordnance Survey 100022432.This map is to be used for the purposes of viewing the location of Anglian Water plant only. Any other uses of the map data or further copies is not permitted. This notice is not intended to exclude or restrict liability for death or personal injury resulting from negligence.

- Foul Sewer
- Surface Sewer
- Combined Sewer
- Final Effluent
- Rising Main*
- Private Sewer*
- Decommissioned Sewer*
- Outfall*
- Inlet*
- Manhole*
- Sewage Treatment Works
- Public Pumping Station
- Decomissioned Pumping Station

*(Colour denotes effluent type)

yvonne.paul@kier.co.uk

love every drop anglianwater

Appendix B – LCC Highways and LLFA Developer Enquiry

Allan Jones

From: Graham Simpson <Graham.Simpson@lincolnshire.gov.uk>
Sent: 01 February 2022 14:51
To: Allan Jones
Cc: Sarah Jones; Dan Goodman
Subject: RE: William Stukeley CofE Primary School - Access Road and Car Park [<AX756038>]

Follow Up Flag: Follow up
Flag Status: Completed

[This email was sent from an external sender outside of the Kier Group, please treat this email, links and attachments with caution.]

Hi Allan

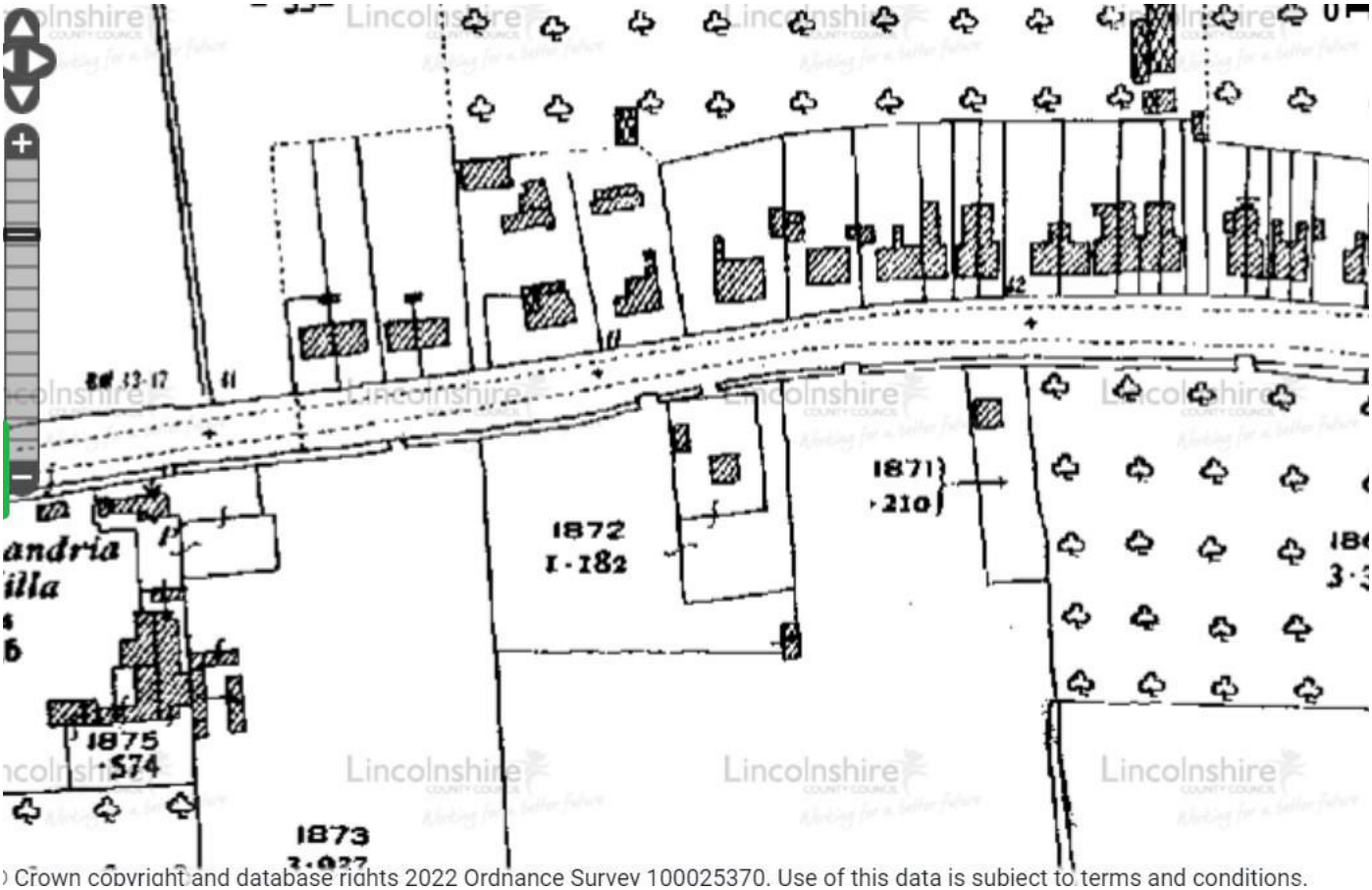
Below is a plan hopefully showing the extent of the drainage as requested that we are aware of, if you need any more just ask. I would advise that the plan basically shows drainage we are aware of, the system may be highway, AWA or land drainage.

I have also included a screenshot of the 1905 OS map, you can see before this area was developed there use to be a land drainage ditch alongside Spalding Road. This would seem to indicate that the ditch was replaced with the pipe shown on the current plans. Therefore although we have no idea who installed the pipe, it may have been developers/LCC etc etc it would be reasonable to still consider it to be part of a land drainage system. This may be of use to you as highway drains are solely for highway use and we do not permit private drainage connections. If considered a land drainage system as long as the IDB are happy (they oversee land drainage) I wouldn't see an issue with you connecting.

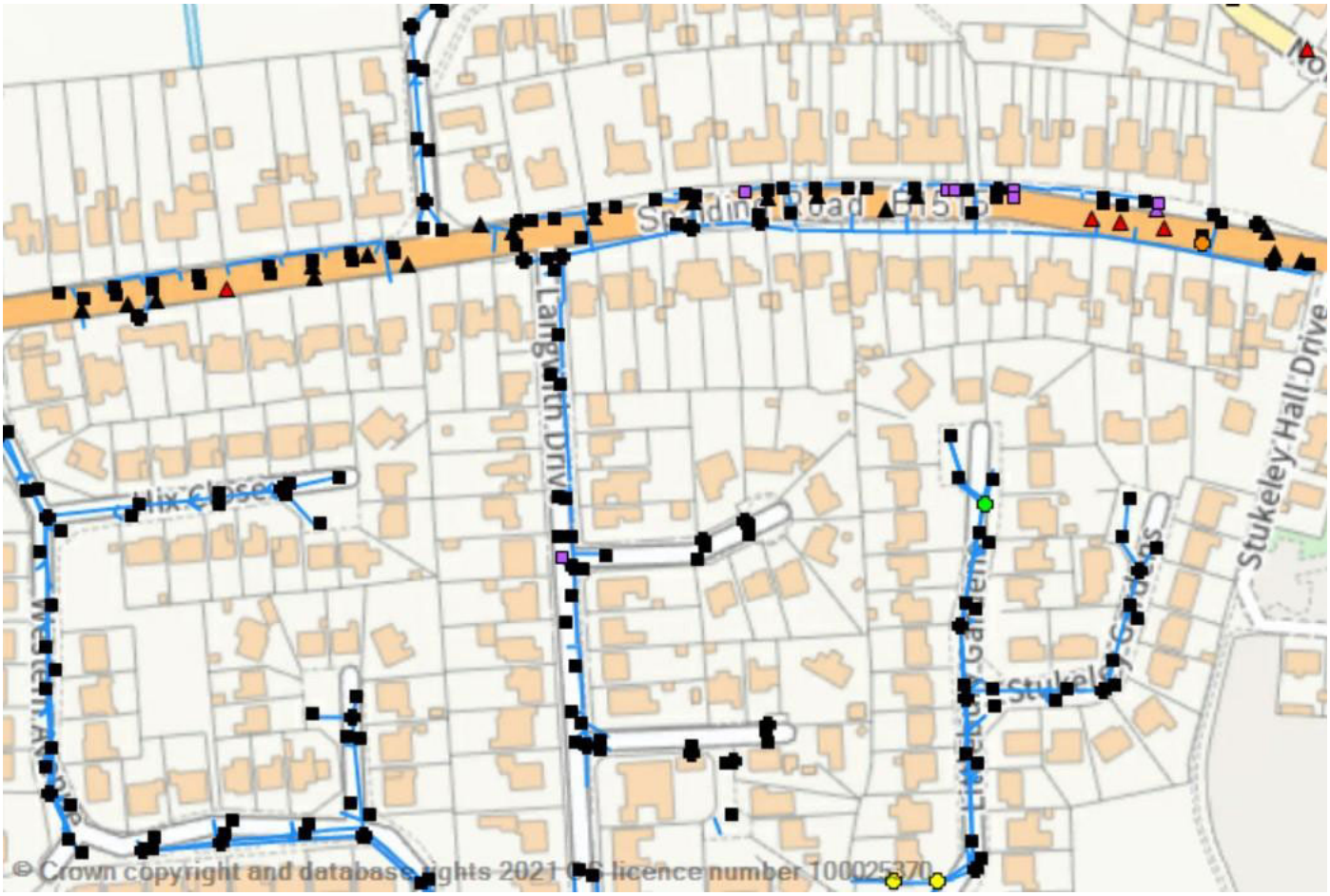
FYI we have many locations like this and although technically such a land drainage pipe would be the adjacent landowners responsibility to maintain, in reality as we have the resources available and its in our interest to keep it working so we as highway authority tend to end up maintaining them.

Hope I've made sense

Graham



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Graham Simpson FIHE
Senior Highways Officer

Lincolnshire County Council, Place Directorate,
Highways Services, Local Highways South,
Lancaster House, 36 Orchard Street, Lincoln LN1 1XX

Phone: 01522 553712
Mobile: 07717 431764
Email: graham,simpson@lincolnshire.gov.uk
Teams: Chat with me
Website: www.lincolnshire.gov.uk

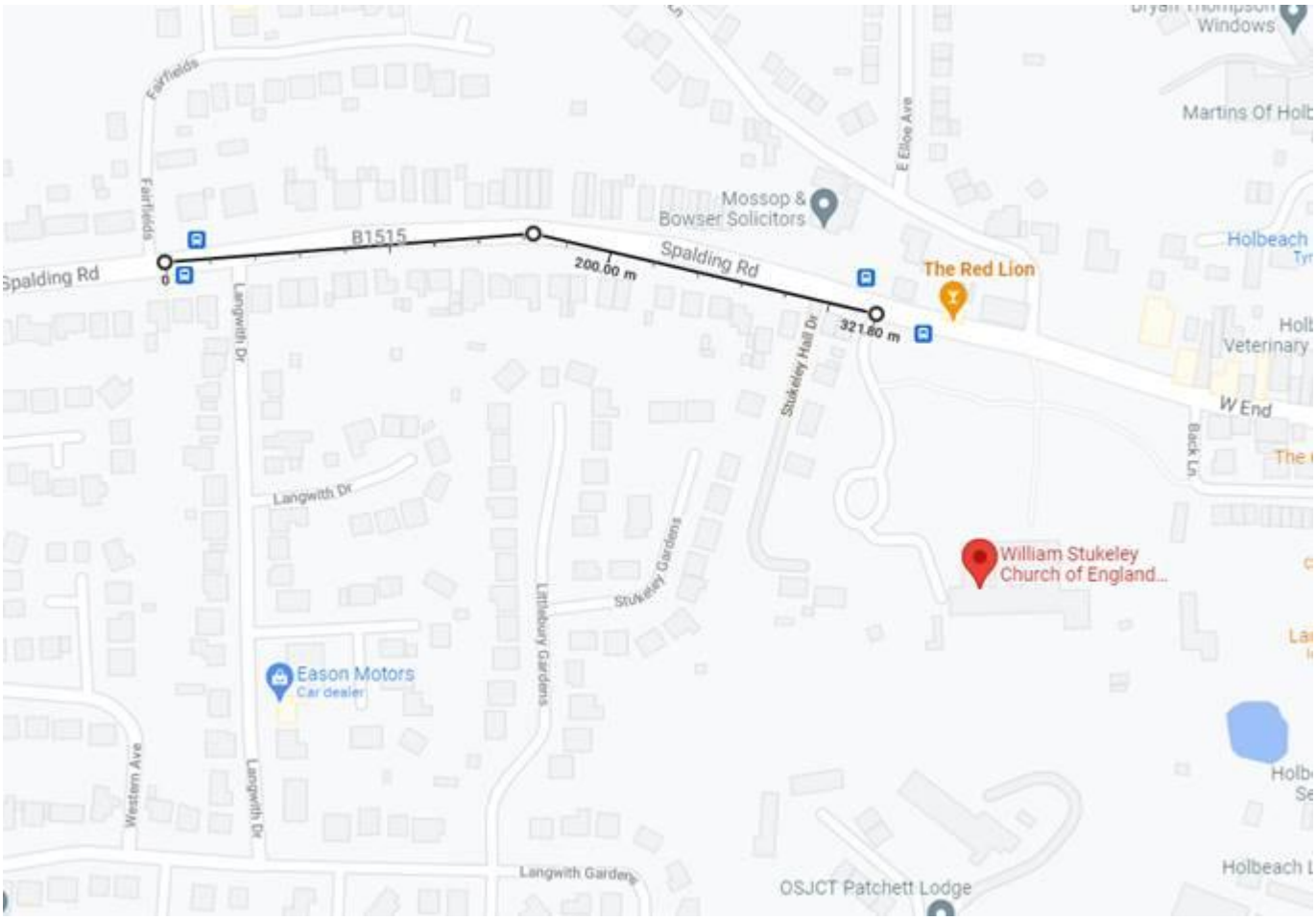
From: Allan Jones <Allan.Jones@kier.co.uk>
Sent: 31 January 2022 15:46
To: Graham Simpson <Graham.Simpson@lincolnshire.gov.uk>
Cc: Sarah Jones <Sarah.E.Jones@kier.co.uk>
Subject: RE: William Stukeley CofE Primary School - Access Road and Car Park [<AX756038>]

Hi Graham,

Further to you kindly providing a copy of the attached highways asset map as below, we have undertaken a number of third-party surveys, including topographical, underground services trace to PAS 128 and CCTV drainage condition survey, for the site and parts of Spalding Road (copy of survey drawings attached).

In addition, we have made enquiries with the Water Management Alliance (WMA), on behalf of the Internal Drainage Board, regarding potential alternative surface water disposal routes owing to site constraints within the Stukeley Park (conservation area and inclusive tree protection orders etc.) and the arboricultural damage that would be caused by working within the tree root protection areas (extract from tree survey also attached) to undertake intrusive site investigation ground surveys, followed by the subsequent removal and replace the failed existing infiltration soakaways.

The attached email follows the WMA's site visit last week and suggests that the highways surface water drains within Spalding Road may be historically connected to their piped adopted watercourse to the west (known as F67 Langwith Drive – Pipeline Pipeline DRN197P6702). To investigate this further, please would you be able to provide further highways asset mapping for the circa 350m+ to the west of the school site entrance, to beyond Langworth Drive (refer to screenshot below for approx. location of the IDB's MH ref D, as per the attached Highways Drainage.jpg)?



If this existing surface water drainage route may be proven by further third-party surveys, and in light that infiltration methods may no longer be feasible within the Stukeley Park owing to the site constraints listed above, please could you advise on the application process that we would need to follow for a new pumped surface water outfall, assumed at greenfield run off rates or 2 l/s, from the access road and car park catchment areas into the highways surface water drain?

We look forward to hearing from you.

Kind regards,

KIER

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From: Graham Simpson <Graham.Simpson@lincolnshire.gov.uk>
Sent: 06 October 2021 12:02

To: Allan Jones <Allan.Jones@kier.co.uk>
Subject: RE: William Stukeley CofE Primary School - Access Road and Car Park [<AX756038>]

[This email was sent from an external sender outside of the Kier Group, please treat this email, links and attachments with caution.]

Hi Allan

Apologies for the delay

Black square should be a gully
Black Circle a manhole
Black triangle an offlet kerb
Blue line – a pipe of some sort ownership not necessarily LCC
Anything coloured orange just means they couldn't clean it last time they went there, green means the cover was jammed, purple had a vehicle parked over it when they went to clean.

Take the plan as a rough guide not accurate

Regards

Graham Simpson FIHE
Senior Highways Officer
Lincolnshire County Council, Place Directorate,
Highways Services, Local Highways South,
Lancaster House, 36 Orchard Street, Lincoln LN1 1XX

Phone: 01522 553712
Mobile: 07717 431764
Email: graham,simpson@lincolnshire.gov.uk
Teams: Chat with me
Website: www.lincolnshire.gov.uk

From: Allan Jones <Allan.Jones@kier.co.uk>
Sent: 16 September 2021 17:16
To: Graham Simpson <Graham.Simpson@lincolnshire.gov.uk>
Cc: Dan Goodman <Dan.Goodman@lincolnshire.gov.uk>; Kyra Nettle <Kyra.Nettle@lincolnshire.gov.uk>; Richard Fenwick <Richard.Fenwick@lincolnshire.gov.uk>; Sarah Jones <Sarah.E.Jones@kier.co.uk>
Subject: RE: William Stukeley CofE Primary School - Access Road and Car Park [<AX756038>]

Hi Graham,

Thanks for getting back to me so quickly.

Please would you be able to provide a Key as to what the symbols on the image mean (circles, squares, triangles and the different colours)?

Kind regards,

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From: Graham Simpson <Graham.Simpson@lincolnshire.gov.uk>
Sent: 15 September 2021 16:05
To: Allan Jones <Allan.Jones@kier.co.uk>
Cc: Dan Goodman <Dan.Goodman@lincolnshire.gov.uk>; Kyra Nettle <Kyra.Nettle@lincolnshire.gov.uk>; Richard Fenwick <Richard.Fenwick@lincolnshire.gov.uk>
Subject: RE: William Stukeley CofE Primary School - Access Road and Car Park [<AX756038>]

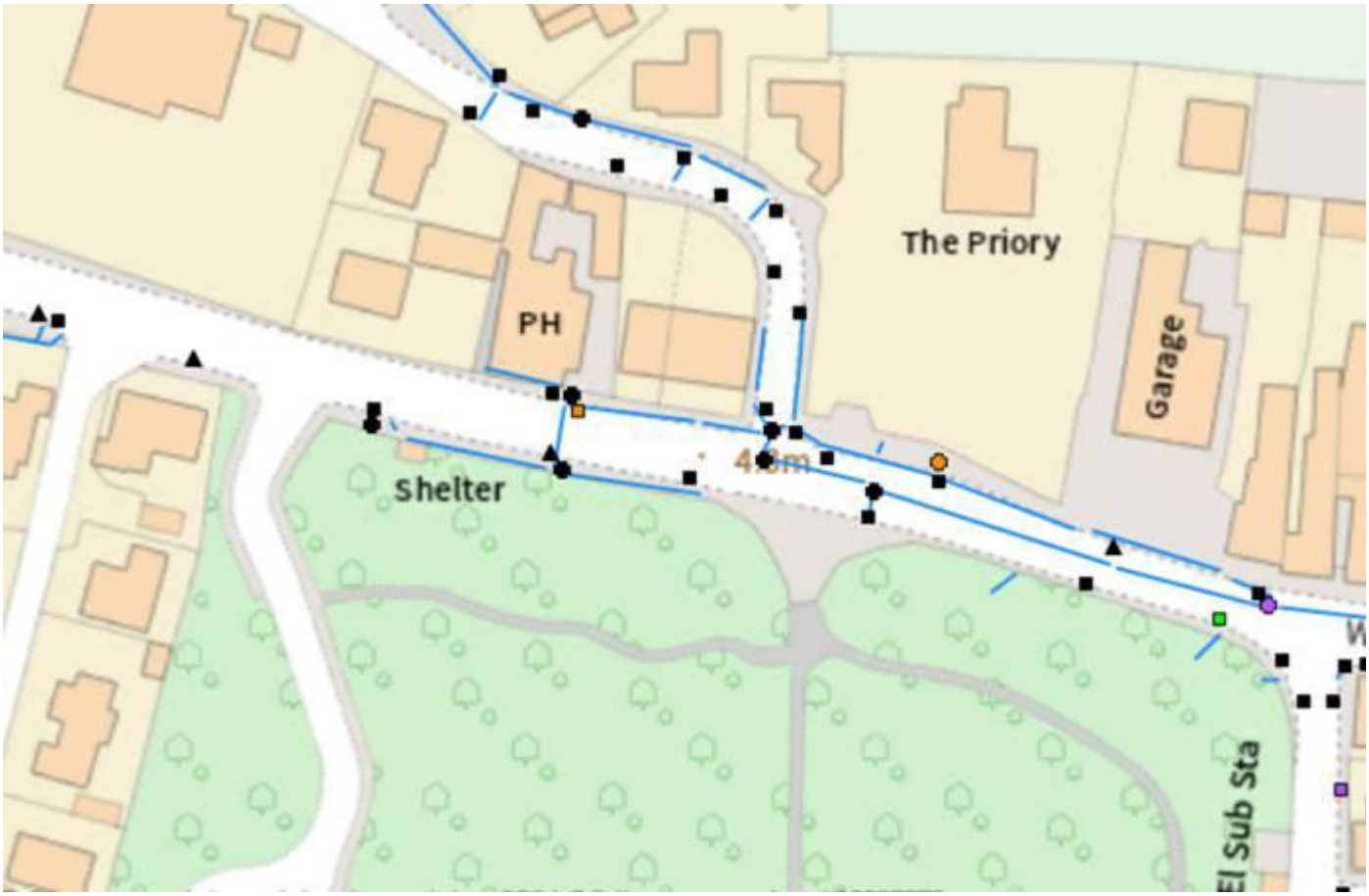
[This email was sent from an external sender outside of the Kier Group, please treat this email, links and attachments with caution.]

Hello Alan

Below is a copy of our drainage record for the area adjacent William Stukeley School.

It is only a schematic indication and I'm afraid it is incomplete, and does not include any detail on condition of pipe or diameters etc.

Regards



Graham Simpson FIHE
Senior Highways Officer
Lincolnshire County Council, Place Directorate,
Highways Services, Local Highways South,
Lancaster House, 36 Orchard Street, Lincoln LN1 1XX

Phone: 01522 553712
Mobile: 07717 431764
Email: graham,simpson@lincolnshire.gov.uk
Teams: Chat with me
Website: www.lincolnshire.gov.uk

Lincolnshire COUNTY COUNCIL *Working for a better future*

From: CSC_HP_OnlineForms <CSC_HP_OnlineForms@lincolnshire.gov.uk>
Sent: 15 September 2021 15:05
To: Graham Simpson <Graham.Simpson@lincolnshire.gov.uk>
Cc: Dan Goodman <Dan.Goodman@lincolnshire.gov.uk>; Kyra Nettle <Kyra.Nettle@lincolnshire.gov.uk>; Richard Fenwick <Richard.Fenwick@lincolnshire.gov.uk>
Subject: Fw: William Stukeley CofE Primary School - Access Road and Car Park [<AX756038>]

Good afternoon, please see email below and respond accordingly.

Thanks

Yours sincerely

Customer Services

www.lincolnshire.gov.uk/faultreporting

On behalf of Highways and Planning Team

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Please report any non-urgent highways issues using our online reporting tool at www.lincolnshire.gov.uk/faultreporting/faultreporting

For information on road works and major schemes, follow @LincsCC_roads on Twitter

EMail from Customer
Date: Wednesday, September 15, 2021 11:56:20 AM

From: Allan.Jones@kier.co.uk
To: "'cschighways@lincolnshire.gov.uk'" <cschighways@lincolnshire.gov.uk>

Subject: William Stukeley CofE Primary School - Access Road and Car Park

Good morning,

On behalf of Lincolnshire County Council, we have been instructed to prepare highways resurfacing and surface water remedial details to the access road and informal car parking areas at William Stukeley Park and William Stukeley Church of England Primary School, Spalding Rd, Holbeach, Spalding PE12 7HG.

The access road has been reported to be subject to surface water flooding and a number of kerb sets and gulleys have failed (please refer to the attached photos).

As part of our design considerations, we need to determine the public sewers and/or private drains on, or adjacent to, the development site.

Please refer to the enclosed existing site plan (red line boundary), utilities survey drawings, Anglian Water public sewer records and EA flood risk map for information.

Soakway testing is to be undertaken in accordance with BRE 365 as part of the site investigation survey to determine whether infiltration drainage would be feasible at this site for surface water drainage design. Should infiltration drainage not be feasible we may need to seek permission to discharge surface water to the public sewer under the SuDS hierarchy.

We note the presence of a foul sewer and surface water drains within the B1515 Spalding Road/West End highway. Please would you be able to confirm the details of any surface water drainage assets serving the

public highway (B1515 Spalding Road/West End and Stukeley Hall Drive) that may be under your ownership and the possibilities of accepting surface water discharge from the proposed remedial scheme, if required?

We look forward to hearing from you.

Kind regards,

KIER

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Allan Jones BEng (Hons) CEng MICE
Principal Civil Engineer

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Attachments:
image001.png
2021.09.15 Site Info to LCC Highways.zip

Attachments:
2021.09.15 Site Info to LCC Highways.zip
image001.png

Closed Reason Code: CSC_ForwardedEmail

Agent Note:

EMail from Customer
Date: Wednesday, September 15, 2021 11:56:20 AM

From: Allan.Jones@kier.co.uk
To: "'cschighways@lincolnshire.gov.uk'" <cschighways@lincolnshire.gov.uk>

Subject: William Stukeley CofE Primary School - Access Road and Car Park

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We note the presence of a foul sewer and surface water drains within the B1515 Spalding Road/West End highway. Please would you be able to confirm the details of any surface water drainage assets serving the public highway (B1515 Spalding Road/West End and Stukeley Hall Drive) that may be under your ownership and the possibilities of accepting surface water discharge from the proposed remedial scheme, if required?

We look forward to hearing from you.

Kind regards,

KIER

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Attachments:
image001.png
2021.09.15 Site Info to LCC Highways.zip

Allan Jones

From:	Allan Jones
Sent:	24 February 2023 09:37
To:	'cschighways@lincolnshire.gov.uk'; 'FloodRisk'
Cc:	'Graham Simpson'; 'Daniel Adams'; Dan Goodman
Subject:	William Stukeley CofE Primary School, Spalding Rd, Holbeach, Spalding PE12 7HG - Pre-Development Enquiry for Proposed Building Extensions
Attachments:	36222-DBS-XX-XX-L-C-0001-Document Issue Record-S2-P02.pdf; 36222-DBS-00-XX-DR-C-0001-DrainageLayoutSheet1-S3-P01.pdf; 36222-DBS-00-XX-DR-C-0002-DrainageLayoutSheet2-S3-P01.pdf; 36222-DBS-00-XX-DR-C-0004-ProposedExternalWorksGA-S3-P01.pdf; LDC4062 FRA.pdf

FAO Local Lead Flood Authority

Good morning,

On behalf of LCC, Kier have been instructed by Lindum group to develop design proposals for the expansion of the William Stukeley Primary school building to become a 2-form entry.

The site is split between Flood Zone 2 and Flood Zone 3, with the existing building being in Flood Zone 2. A Flood Risk Assessment dated 17.11.2022 has been provided by Lincs Design Consultancy, a copy of the report is enclosed for information.

A suite of third-party surveys have been carried out that indicate the existing surface water drainage on site, based on traditional 'stone filled trench' soakaways, is at end of life owing to a lack of access for maintenance. Recent infiltration testing carried out on site in January 2023, near the proposed building extensions and existing linear soakaway to the south of the school playground, suggests that soakaway design to current standards, such as BRE 365, would be unfeasible. As there is no option to deal with the historic and additional proposed surface water on site, and with no watercourse or other SuDS hierarchy to discharge to, we have developed a pumped surface water drainage solution to discharge at a reasonable rate of 2 l/s to the SW sewer in Spalding Road under riparian ownership rights. Please find enclosed details of the proposed drainage design for your information.

Further to our previous discussions with LCC Highways (cc'd to this email) regarding the proposed drainage remedial works to the access road and car park for this site, LCC have decided to monitor the on-site situation before committing to positively drain these areas to the SW sewer in Spalding Road and the resulting pass forward flows to the IDB drainage network at MH D of F67 Langwith Drive.

We are in discussion with the Internal Drainage Board and understand that formal consent from the Board would be required to positively drain from the site and that a formal application and payment of a Surface Water Development Contribution will be required in due course.

We would be grateful to if you could please provide any comments on the above which may be taken into consideration within a Planning application that is to be made.

Please let me know if you have any queries or require any further information.

We look forward to hearing from you.

Kind regards,

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Principal Civil Engineer

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Appendix C – IDB Developer Enquiry

Allan Jones

From: Planning Department <planning@wlma.org.uk>
Sent: 09 March 2023 15:56
To: Allan Jones
Subject: RE: William Stukeley CofE Primary School, Spalding Rd, Holbeach, Spalding PE12 7HG - Pre-Development Enquiry for Proposed Building Extensions

Follow Up Flag: Follow up
Flag Status: Completed

External Email Please do not click links or open attachments unless you trust the sender and know the content is safe. If in doubt, contact the IT Service Desk.

Our Ref: 23_21609_Q

Good afternoon Allan,

Thank you for your emails and my apologies for not responding sooner.

I have now had chance to have an initial review of the plans for the pumped surface water drainage system from the primary school and proposed expansions to the SW sewer along Spalding Road, connecting to the Board maintained drain F67 Langwith Drive to the west.

At this stage, I can offer our standard planning application advice relating to the discharge of surface water and Byelaw 3 consent requirements. As you are aware from our previous communications, if you wish to connect the pumped 2 l/s discharge to the existing SW sewer running parallel to Spalding Road, you will require consent under Byelaw 3. We recommend that any discharge is in line with the Non-Statutory technical standards for sustainable drainage systems (SuDS) and therefore should be restricted to the greenfield run-off rate where possible.

From discussions with our Operations Manager, there were no initial major concerns with the concept, however, the main points to consider include the storage capacity of the attenuation tank and the long-term maintenance of the tank (will this be the school as the riparian owner or a management company), as it was recognised that the capacity will be reduced over time with the build-up of silt. Information would also be required on the condition and ownership/maintenance of the receiving SW sewer to ensure it is suitable to take on the additional surface water before connecting to the IDB maintained drain. This would be looked at in further detail as part of a review of any forthcoming consent application and we would be happy to discuss this at that stage.

If you require any further information, please do not hesitate to ask.

Kind Regards,

Will Chandler BSc (Hons), MCIWEM
Sustainable Development Officer
Water Management Alliance
m: 07826 940760 | dd: 01553 819630 | William.Chandler@wlma.org.uk

Registered office: Pierpoint House, 28 Horsley's Fields, King's Lynn, Norfolk, PE30 5DD
t: 01553 819600 | e: info@wlma.org.uk | www.wlma.org.uk

WMA members: Broads Drainage Board, East Suffolk Drainage Board, King's Lynn Drainage Board, Norfolk Rivers Drainage Board, South Holland Drainage Board, Waveney, Lower Yare and Lothingland IDB in association with Pevensey and Cuckmere Water Level Management Board

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From: Allan Jones <Allan.Jones@kier.co.uk>
Sent: Monday, March 6, 2023 1:51 PM
To: Planning Department <planning@wlma.org.uk>
Subject: FW: William Stukeley CofE Primary School, Spalding Rd, Holbeach, Spalding PE12 7HG - Pre-Development Enquiry for Proposed Building Extensions

Hi Will,

Further to the email below, we're just following up to see if you may have any initial comments on the SW drainage proposals for the above development prior to us submitting for Planning. If so, we'd be grateful if you could please forward these at your earliest convenience.

We look forward to hearing from you.

Kind regards,

KIER

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From: Allan Jones
Sent: Friday, February 24, 2023 9:39 AM
To: 'Planning Department' <Planning@wlma.org.uk>
Subject: William Stukeley CofE Primary School, Spalding Rd, Holbeach, Spalding PE12 7HG - Pre-Development Enquiry for Proposed Building Extensions

FAO Will Chandler

Good morning Will,

Further to our previous discussions regarding the proposed drainage remedial works to the access road and car park, LCC have decided to monitor the on-site situation before committing to positively drain these areas to the SW sewer in Spalding Road and the resulting pass forward flows to the IDB drainage network at MH D of F67 Langwith Drive.

On behalf of LCC, Kier have been instructed by Lindum group to develop design proposals for the expansion of the William Stukeley Primary school building to become a 2-form entry. A suite of third-party surveys have been carried out that reports the existing surface water drainage on site, based on traditional 'stone filled trench' soakaways, is at end of life owing to a lack of access for maintenance. Recent infiltration testing carried out on site in January 2023, near the proposed building extensions and existing linear soakaway to the south of the school playground, indicated that soakaway design to current standards, such as BRE 365, would be unfeasible. As there is no option to deal with the historic and additional proposed surface water on site, and with no watercourse or other SuDS hierarchy option to discharge to, we have developed a pumped surface water drainage solution to discharge at a reasonable rate of 2 l/s to the SW sewer in Spalding Road under riparian ownership rights. Please find enclosed details of the proposed drainage design for your information.

We understand that formal consent from the Board would be required to positively drain from the site and that a formal application and payment of a Surface Water Development Contribution will be required in due course.

We would be grateful to if you could please provide any comments on the above which may be taken into consideration within a Planning application that is to be made.

We look forward to hearing from you.

Kind regards,

KIER

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Principal Civil Engineer

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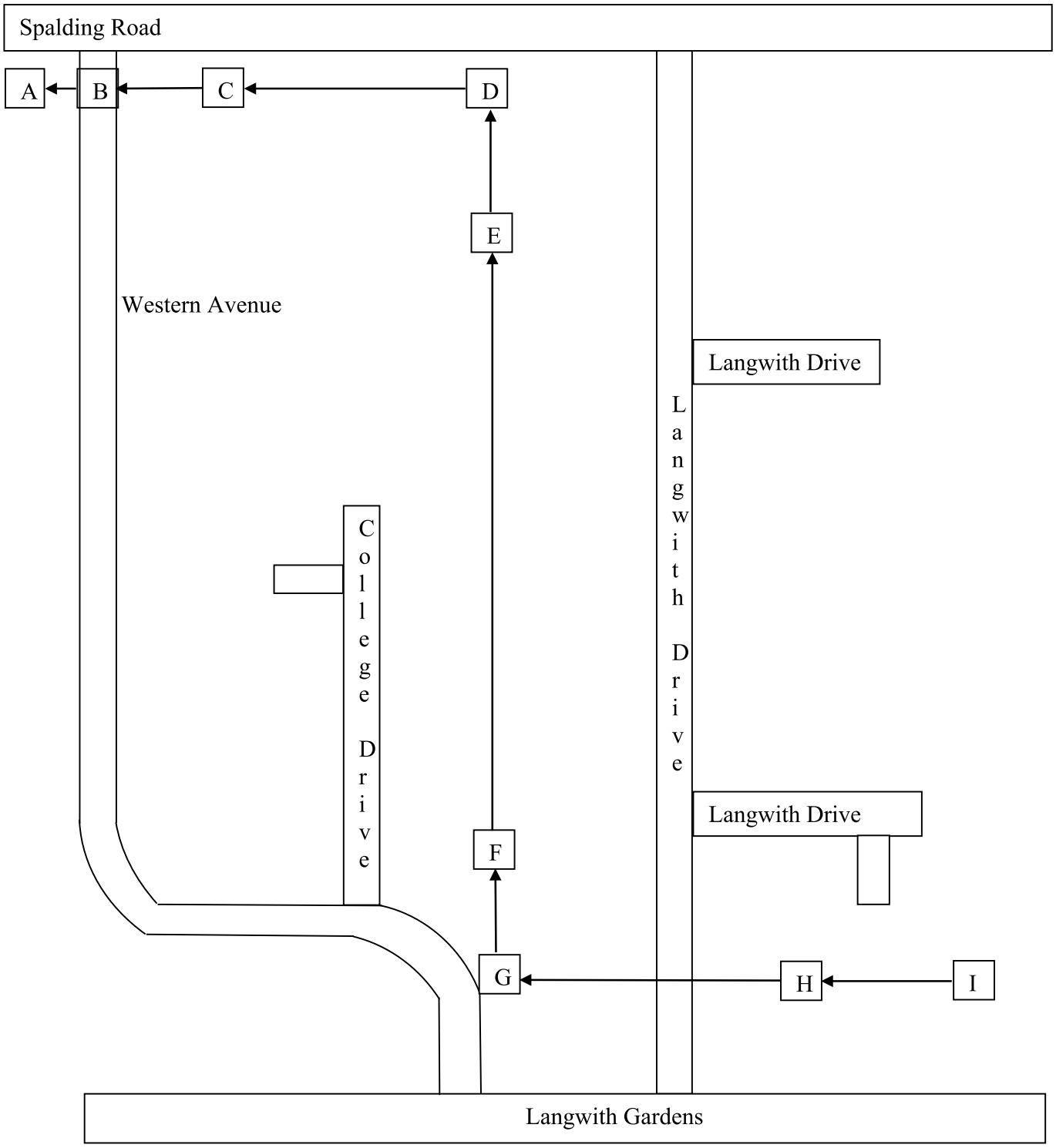
T: 01522 836560
M: 07742 406323
E: allan.jones@kier.co.uk

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F67 Langwith Drive Drain Holbeach



MH A-In the verge opposite Muskholm property Spalding Road
MH B-In the road in the junction of Western Avenue with Spalding Road.
MH C-In the front garden of No.63 Spalding Road.
MH D-In the front garden of No.51 Spalding Road.
MH E-In the back garden of No.51 Spalding Road.
MH F-In the back garden under the fence line of No.9 College Close.
MH G-In the verge off Western Avenue.
MH H-In the back garden of No.1 of Langwith Garden.
MH I-In the back garden of No.49 Langwith Drive.

Appendix D – Proposed Drainage Drawings

Proposed Drainage Drawings are provided within a separate file:

36222-DBS-ZZ-ZZ-T-C-1001-DrainageStrategy-AppendixD-ProposedDrainageDrawings.pdf

Appendix E – Proposed Drainage Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	19.000	Volumetric Runoff Coeff.	0.750	Min Design Depth for Optimisation (m)	1.200
Ratio R	0.400	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	550	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200		

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.118	4-8	0.141	8-12	0.048	12-16	0.009

Total Area Contributing (ha) = 0.316

Total Pipe Volume (m^3) = 10.988

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	10.140	0.169	60.0	0.015	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	11.300	0.141	80.0	0.004	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.002	10.486	0.131	80.0	0.018	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	17.500	0.292	60.0	0.023	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.004	6.714	0.067	100.0	0.019	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.005	4.134	0.041	100.0	0.004	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	34.695	0.116	300.0	0.119	10.00	0.0	0.600	o	300	Pipe/Conduit	
S2.001	9.000	0.030	300.0	0.064	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.002	8.000	0.027	300.0	0.010	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.003	27.800	0.093	300.0	0.024	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.006	9.100	0.030	300.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.007	8.021	0.027	300.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S3.000	22.692	0.151	150.0	0.008	5.00	0.0	0.600	o	150	Pipe/Conduit	
S3.001	2.099	0.035	60.0	0.008	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.008	8.627	0.029	300.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.009	24.442	0.081	300.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.010	10.000	0.033	303.0	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	51.46	5.13	3.200	0.015	0.0	0.0	0.0	1.30	23.0	2.1
S1.001	50.73	5.30	3.031	0.019	0.0	0.0	0.0	1.12	19.9	2.6
S1.002	50.07	5.45	2.890	0.037	0.0	0.0	0.0	1.12	19.9	5.0
S1.003	49.16	5.68	2.759	0.060	0.0	0.0	0.0	1.30	23.0	8.0
S1.004	48.82	5.76	2.392	0.079	0.0	0.0	0.0	1.31	52.0	10.4
S1.005	48.62	5.82	2.325	0.083	0.0	0.0	0.0	1.31	52.0	10.9
S2.000	35.63	10.64	2.335	0.119	0.0	0.0	0.0	0.90	63.8	11.5
S2.001	35.34	10.81	2.219	0.183	0.0	0.0	0.0	0.90	63.8	17.5
S2.002	35.08	10.95	2.189	0.193	0.0	0.0	0.0	0.90	63.8	18.3
S2.003	34.21	11.47	2.163	0.217	0.0	0.0	0.0	0.90	63.8	20.1
S1.006	33.94	11.64	2.070	0.300	0.0	0.0	0.0	0.90	63.8	27.6
S1.007	33.71	11.78	2.040	0.300	0.0	0.0	0.0	0.90	63.8	27.6
S3.000	50.03	5.46	2.550	0.008	0.0	0.0	0.0	0.82	14.5	1.1
S3.001	49.92	5.49	2.399	0.016	0.0	0.0	0.0	1.30	23.0	2.2
S1.008	33.46	11.94	2.013	0.316	0.0	0.0	0.0	0.90	63.8	28.6
S1.009	32.77	12.39	1.984	0.316	0.0	0.0	0.0	0.90	63.8	28.6
S1.010	32.22	12.78	1.500	0.316	0.0	0.0	0.0	0.44	3.4«	28.6

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
SSW01	3.900	0.700	Open Manhole	450	S1.000	3.200	150				
SSW02	3.770	0.739	Open Manhole	450	S1.001	3.031	150	S1.000	3.031	150	
SSW03	3.800	0.910	Open Manhole	450	S1.002	2.890	150	S1.001	2.890	150	
SSW04	3.900	1.141	Open Manhole	450	S1.003	2.759	150	S1.002	2.759	150	
SSW05	3.750	1.358	Open Manhole	600	S1.004	2.392	225	S1.003	2.467	150	
SSW06	3.700	1.375	Open Manhole	600	S1.005	2.325	225	S1.004	2.325	225	
SSW07	3.850	1.515	Open Manhole	1050	S2.000	2.335	300				
SSW08	3.750	1.531	Open Manhole	1050	S2.001	2.219	300	S2.000	2.219	300	
SSW09	3.700	1.511	Open Manhole	600	S2.002	2.189	300	S2.001	2.189	300	
SRWP	4.000	1.837	Junction		S2.003	2.163	300	S2.002	2.163	300	
SSW11	3.700	1.630	Open Manhole	1200	S1.006	2.070	300	S1.005	2.284	225	139
								S2.003	2.070	300	
SSW12	3.560	1.520	Open Manhole	1200	S1.007	2.040	300	S1.006	2.040	300	
SSW13	3.300	0.750	Open Manhole	450	S3.000	2.550	150				
SSW14	3.350	0.951	Open Manhole	450	S3.001	2.399	150	S3.000	2.399	150	
SJcn	3.330	1.317	Junction		S1.008	2.013	300	S1.007	2.013	300	
								S3.001	2.364	150	201
SSW15	3.560	1.576	Open Manhole	1200	S1.009	1.984	300	S1.008	1.984	300	
STank+Pump	3.200	1.700	Open Manhole	1050	S1.010	1.500	100	S1.009	1.903	300	603
SPumped Main	3.150	1.683	Open Manhole	0		OUTFALL		S1.010	1.467	100	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SSW01	535675.393	324798.587	535675.393	324798.587	Required	
SSW02	535685.525	324798.187	535685.525	324798.187	Required	
SSW03	535686.503	324787.045	535686.503	324787.045	Required	
SSW04	535691.692	324777.933	535691.692	324777.933	Required	
SSW05	535693.540	324760.513	535693.540	324760.513	Required	
SSW06	535700.251	324760.328	535700.251	324760.328	Required	
SSW07	535622.629	324755.132	535622.629	324755.132	Required	
SSW08	535657.302	324753.892	535657.302	324753.892	Required	
SSW09	535666.293	324754.566	535666.293	324754.566	Required	
SRWP	535674.169	324755.297			No Entry	
SSW11	535701.948	324756.558	535701.948	324756.558	Required	
SSW12	535705.580	324748.158	535705.580	324748.158	Required	
SSW13	535677.296	324744.657	535677.296	324744.657	Required	
SSW14	535699.805	324745.445	535699.805	324745.445	Required	
SJcn	535699.064	324743.481			No Entry	
SSW15	535691.349	324739.621	535691.349	324739.621	Required	

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Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
STank+Pump	535693.735	324715.296	535693.735	324715.296	Required	
SPumped Main	535683.759	324714.336			No Entry	

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.015	0.015	0.015
1.001	-	-	100	0.004	0.004	0.004
1.002	-	-	100	0.018	0.018	0.018
1.003	-	-	100	0.023	0.023	0.023
1.004	-	-	100	0.019	0.019	0.019
1.005	-	-	100	0.004	0.004	0.004
2.000	-	-	100	0.119	0.119	0.119
2.001	-	-	100	0.064	0.064	0.064
2.002	-	-	100	0.010	0.010	0.010
2.003	-	-	100	0.024	0.024	0.024
1.006	-	-	100	0.000	0.000	0.000
1.007	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.008	0.008	0.008
3.001	-	-	100	0.008	0.008	0.008
1.008	-	-	100	0.000	0.000	0.000
1.009	-	-	100	0.000	0.000	0.000
1.010	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.316	0.316	0.316

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.010	SPumped Main	3.150	1.467	0.000	0	0

Simulation Criteria for Storm

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

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

Synthetic Rainfall Details

Rainfall Model		FSR	M5-60 (mm) 19.000	Cv (Summer)	0.750
Return Period (years)		1	Ratio R 0.400	Cv (Winter)	0.840
Region	England and Wales	Profile Type	Summer	Storm Duration (mins)	30

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Online Controls for Storm

Pump Manhole: STank+Pump, DS/PN: S1.010, Volume (m³): 3.1

Invert Level (m) 1.500

Depth (m)	Flow (l/s)
0.200	2.0000

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Storage Structures for Storm

Cellular Storage Manhole: STank+Pump, DS/PN: S1.010

Invert Level (m) 1.550 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	163.8	163.8	1.000	163.8	215.0	1.100	0.0	215.0

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Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.400 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DTS Status ON Inertia Status OFF
Analysis Timestep Fine DVD Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 25, 25

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)
S1.000	SSW01	15 Winter	100	+25%	100/15 Summer				3.788	0.438	0.000	0.34	
S1.001	SSW02	15 Winter	100	+25%	100/15 Summer				3.761	0.580	0.000	0.50	
S1.002	SSW03	15 Winter	100	+25%	30/15 Summer				3.743	0.703	0.000	0.93	
S1.003	SSW04	15 Winter	100	+25%	30/15 Summer				3.639	0.731	0.000	1.27	
S1.004	SSW05	15 Winter	100	+25%	30/15 Summer				3.178	0.561	0.000	0.98	
S1.005	SSW06	15 Winter	100	+25%	30/15 Summer				3.129	0.579	0.000	1.24	
S2.000	SSW07	15 Winter	100	+25%	30/15 Summer				3.397	0.762	0.000	0.76	
S2.001	SSW08	15 Winter	100	+25%	30/15 Summer				3.336	0.817	0.000	1.28	
S2.002	SSW09	15 Winter	100	+25%	30/15 Summer				3.272	0.783	0.000	1.39	
S2.003	SRWP	720 Winter	100	+25%					2.463	0.000	0.000	0.14	
S1.006	SSW11	15 Winter	100	+25%	30/15 Summer				3.077	0.707	0.000	2.21	
S1.007	SSW12	15 Winter	100	+25%	30/15 Summer				2.898	0.558	0.000	2.25	
S3.000	SSW13	15 Winter	100	+25%	100/15 Winter				2.740	0.040	0.000	0.30	
S3.001	SSW14	15 Winter	100	+25%	100/15 Summer				2.723	0.175	0.000	0.66	
S1.008	SJcn	30 Summer	100	+25%	30/15 Summer				2.514	0.201	0.000	1.68	
S1.009	SSW15	480 Winter	100	+25%	30/15 Summer				2.516	0.232	0.000	0.32	
S1.010	STank+Pump	480 Winter	100	+25%	1/15 Summer				2.514	0.914	0.000	0.63	

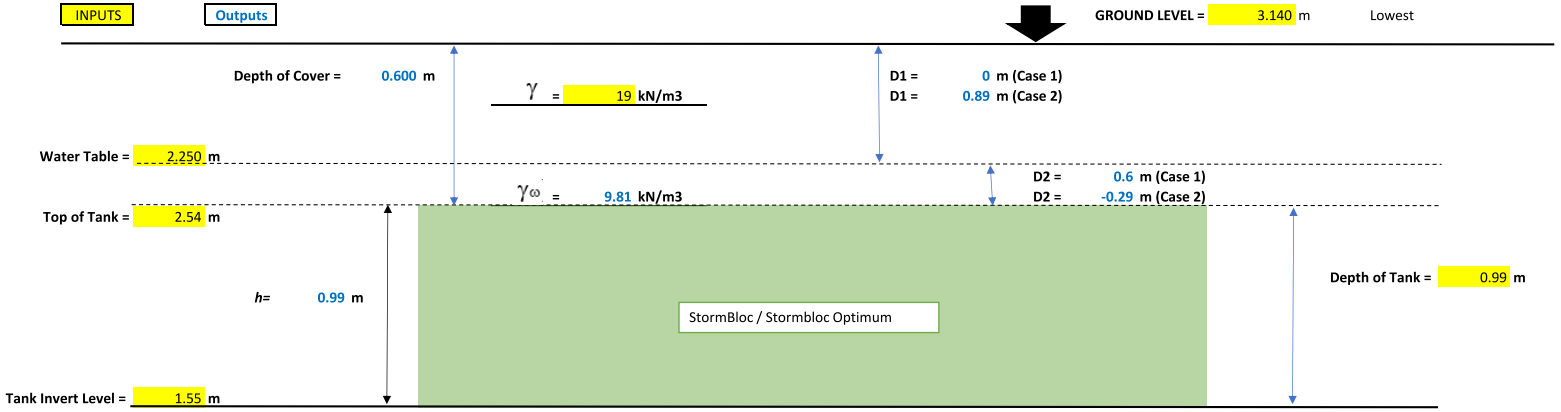
PN	US/MH Name	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	SSW01		7.0	FLOOD RISK	
S1.001	SSW02		8.9	FLOOD RISK	
S1.002	SSW03		16.6	FLOOD RISK	
S1.003	SSW04		27.2	FLOOD RISK	
S1.004	SSW05		35.7	SURCHARGED	
S1.005	SSW06		37.0	SURCHARGED	
S2.000	SSW07		44.9	SURCHARGED	
S2.001	SSW08		62.4	SURCHARGED	
S2.002	SSW09		66.1	SURCHARGED	
S2.003	SRWP		9.2	SURCHARGED*	
S1.006	SSW11		108.3	SURCHARGED	
S1.007	SSW12		107.4	SURCHARGED	
S3.000	SSW13		4.1	SURCHARGED	
S3.001	SSW14		7.8	SURCHARGED	
S1.008	SJcn		103.2	SURCHARGED*	
S1.009	SSW15		18.1	SURCHARGED	
S1.010	STank+Pump		2.0	SURCHARGED	

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William Stukeley Primary
36222-DBS-XX-XX-T-C-0002-S4-P01
08.03.2023

Floatation calculation sheet for stormwater attenuation — TANK 1

INPUTS | Outputs



Where γ = bulk unit weight of fill material
γ_w = bulk unit weight of water (9.81 kN/m³)
D_1 = minimum depth of cover over the tank above water level
D_2 = depth of cover over the tank below water level

$\gamma_{\omega'}$ = 9.19 kN/m3 Bouyant fill material (Bulk fill material weight - bulk water weight)
$\gamma_{w'}$ = 9.81 kN/m3

Case 1 – Water table at ground level	Case 2 – Water table level above tank	Upthrust
$D_1 \cdot \gamma + D_2 \cdot (\gamma - \gamma_\omega)$	$D_1 \cdot \gamma + D_2 \cdot (\gamma - \gamma_\omega)$	$\gamma_{w'} h$
Output 5.514 kN/m2	Output 14.2449 kN/m2	Output 9.7119 kN/m2
FoS = 0.57	FoS = 1.47	PASS

For Tank 1, consider Case 2 based on maximum recorded groundwater level (Grange Geo SI 2023) and minimum depth of cover provided by reinstatement of grassed surfacing to existing levels.

In lieu of long term groundwater monitoring, maximum recorded level (Delta Simons SI 2018 for Single Classroom Extension to NW corner, approx 100m away) = 2.69m AOD, which would reduce Case 2 FOS to 1.02 if applied to this location.

Summary of Results for 100 year Return Period (+25%)

Half Drain Time : 33 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	2.838	0.088	1.2	2.3	O K
30 min Summer	2.851	0.101	1.2	3.0	O K
60 min Summer	2.859	0.109	1.2	3.4	O K
120 min Summer	2.858	0.108	1.2	3.4	O K
180 min Summer	2.852	0.102	1.2	3.1	O K
240 min Summer	2.846	0.096	1.2	2.7	O K
360 min Summer	2.835	0.085	1.1	2.2	O K
480 min Summer	2.826	0.076	1.0	1.8	O K
600 min Summer	2.820	0.070	0.9	1.5	O K
720 min Summer	2.814	0.064	0.9	1.2	O K
960 min Summer	2.806	0.056	0.7	0.9	O K
1440 min Summer	2.797	0.047	0.6	0.7	O K
2160 min Summer	2.790	0.040	0.4	0.5	O K
2880 min Summer	2.786	0.036	0.3	0.4	O K
4320 min Summer	2.780	0.030	0.2	0.3	O K
5760 min Summer	2.777	0.027	0.2	0.2	O K
7200 min Summer	2.775	0.025	0.2	0.2	O K
8640 min Summer	2.773	0.023	0.1	0.2	O K
10080 min Summer	2.771	0.021	0.1	0.1	O K
15 min Winter	2.845	0.095	1.2	2.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	116.605	0.0	21
30 min Summer	76.630	0.0	32
60 min Summer	48.017	0.0	50
120 min Summer	29.103	0.0	84
180 min Summer	21.439	0.0	116
240 min Summer	17.164	0.0	146
360 min Summer	12.459	0.0	208
480 min Summer	9.933	0.0	268
600 min Summer	8.326	0.0	328
720 min Summer	7.204	0.0	386
960 min Summer	5.730	0.0	504
1440 min Summer	4.143	0.0	740
2160 min Summer	2.991	0.0	1100
2880 min Summer	2.371	0.0	1468
4320 min Summer	1.707	0.0	2204
5760 min Summer	1.351	0.0	2920
7200 min Summer	1.126	0.0	3672
8640 min Summer	0.970	0.0	4368
10080 min Summer	0.854	0.0	5128
15 min Winter	116.605	0.0	22

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Summary of Results for 100 year Return Period (+25%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	2.861	0.111	1.2	3.5	O K
60 min Winter	2.868	0.118	1.2	4.0	O K
120 min Winter	2.864	0.114	1.2	3.7	O K
180 min Winter	2.854	0.104	1.2	3.2	O K
240 min Winter	2.843	0.093	1.2	2.6	O K
360 min Winter	2.829	0.079	1.1	1.9	O K
480 min Winter	2.819	0.069	0.9	1.4	O K
600 min Winter	2.811	0.061	0.8	1.1	O K
720 min Winter	2.804	0.054	0.7	0.9	O K
960 min Winter	2.797	0.047	0.6	0.7	O K
1440 min Winter	2.790	0.040	0.4	0.5	O K
2160 min Winter	2.784	0.034	0.3	0.3	O K
2880 min Winter	2.781	0.031	0.3	0.3	O K
4320 min Winter	2.776	0.026	0.2	0.2	O K
5760 min Winter	2.773	0.023	0.1	0.2	O K
7200 min Winter	2.771	0.021	0.1	0.1	O K
8640 min Winter	2.769	0.019	0.1	0.1	O K
10080 min Winter	2.768	0.018	0.1	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	76.630	0.0	33
60 min Winter	48.017	0.0	54
120 min Winter	29.103	0.0	90
180 min Winter	21.439	0.0	124
240 min Winter	17.164	0.0	154
360 min Winter	12.459	0.0	214
480 min Winter	9.933	0.0	274
600 min Winter	8.326	0.0	332
720 min Winter	7.204	0.0	390
960 min Winter	5.730	0.0	502
1440 min Winter	4.143	0.0	742
2160 min Winter	2.991	0.0	1100
2880 min Winter	2.371	0.0	1464
4320 min Winter	1.707	0.0	2156
5760 min Winter	1.351	0.0	2832
7200 min Winter	1.126	0.0	3632
8640 min Winter	0.970	0.0	4344
10080 min Winter	0.854	0.0	5136

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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)	19.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+25

Time Area Diagram

Total Area (ha) 0.018

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.006	4	8	0.006	8	12	0.006

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Model Details

Storage is Online Cover Level (m) 3.250

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.07160	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	18.0
Max Percolation (l/s)	50.0	Slope (1:X)	200.0
Safety Factor	3.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	2.750	Membrane Depth (m)	0

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