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Benwick Primary School

Drainage & SuDS Strategy

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Benwick Primary School, High Street, March PE15 0XA

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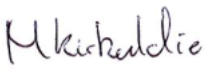
Michael Kirkaldie BSc (Hons) Civil Engineer		22.11.23

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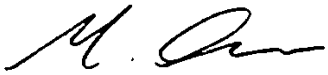
Matthew Martin BSc (Hons) Senior Civil Engineer		22.11.23

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1 Introduction

1.1 Project Overview

Proposals contained or forming part of this report represent the design intent and may be subject to alteration or adjustment in completing the detailed design for this project. Where such adjustments are undertaken as part of the detailed design and are deemed a material derivation from the intent contained in this document, prior approval shall be obtained from the relevant authority in advance of commencing such works.

The application proposal involves replacing the temporary classroom (183m^2) with a permanent one (200m^2). The new classroom would utilise the existing steps & path, there are no changes to external hard or landscaping proposed.

1.2 Site Location

The application site is located in Benwick, March which is within Cambridgeshire County, postcode PE15 0XA. Figure 1-1 shows the redline and land ownership boundary within the local context.

Figure 1-1 Site Location Plan

1.3 Site Description

The 0.7 ha application site is occupied by Benwick Primary School, comprised of the main school building, the temporary classroom to be replaced, a parking area, a playground and play field. The site is relatively flat with the high point being adjacent to the northeastern boundary which abuts High Street road, and the low points being adjacent to the western and southern boundaries. The temporary building has a roof area of 183m^2.

The high point is around 1.2m AOD and the low point is around 0.3m AOD. There is a centralised depression just north of the existing temporary classroom. Figure 1-1 shows an isopachyte of approximate existing site levels.

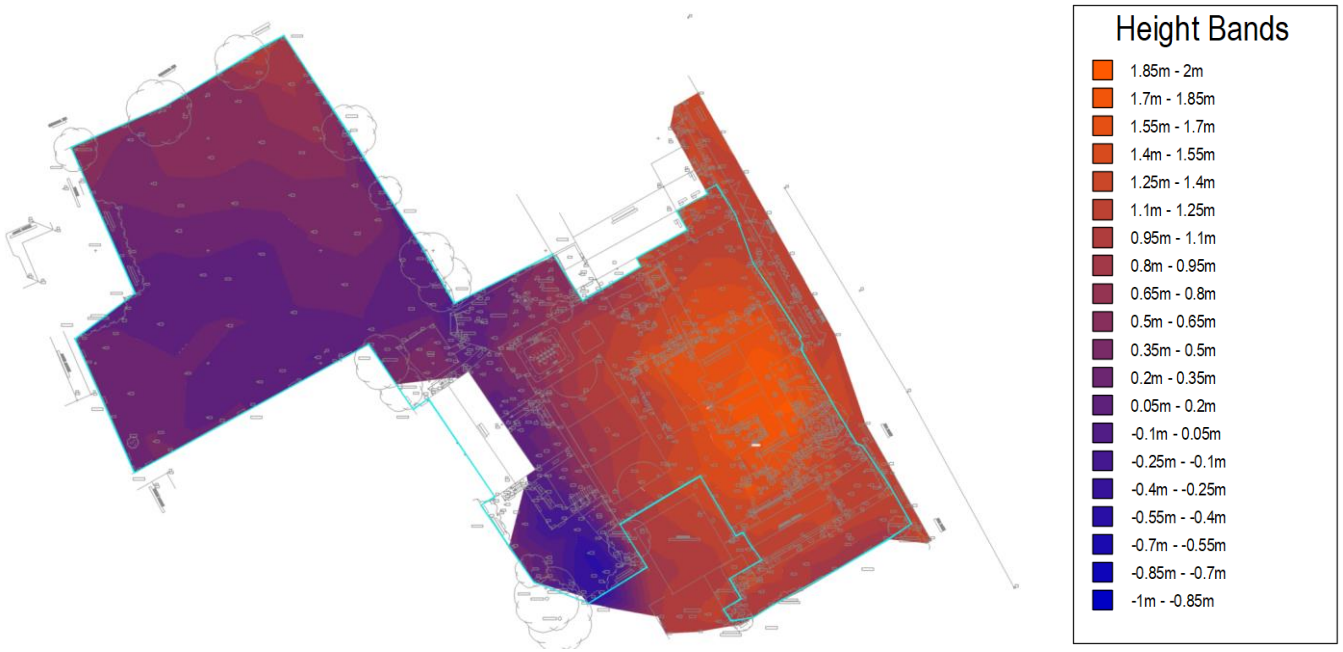

Figure 1-1 Existing Ground Levels Isopachyte

The full topographical survey is contained within **Appendix A** of this report.

1.4 Sub-strata

BRE 365 compliant shallow soakaway testing was undertaken by Geosphere Environmental in September 2023. The survey recorded negligible infiltration, with water level not dropping and the survey being abandoned.

Borehole logs were also undertaken, which denoted the ground makeup as sandy and gravelly initially then clayey, with a more porous lens of gravel approximately 6.2m down at which point groundwater was struck. Table 1 summarises the findings of the borehole which is contained in **Appendix B** of this report.

Depth BGL (m)	Nature of Strata	Water
0.3	Dark Brown slightly gravelly SAND	
0.7	Light Brown slightly gravelly Silty SAND	
1.5	Very soft dark grey and black CLAY	
4.4	Firm dark brown PEAT	
6.2	Dark greyish brown sandy GRAVEL	Inflow of water at 6.2m BGL
8.5	Greyish brown sandy GRAVEL	

1.5 Project Proposal

The application proposal consists of replacing the existing temporary classroom with a permanent one of roof area 200m^2, **Appendix C** contains the site masterplan. Figure 1-2 shows a diagram of the proposed classroom.

The proposed classroom would have a toilet area positioned centrally.

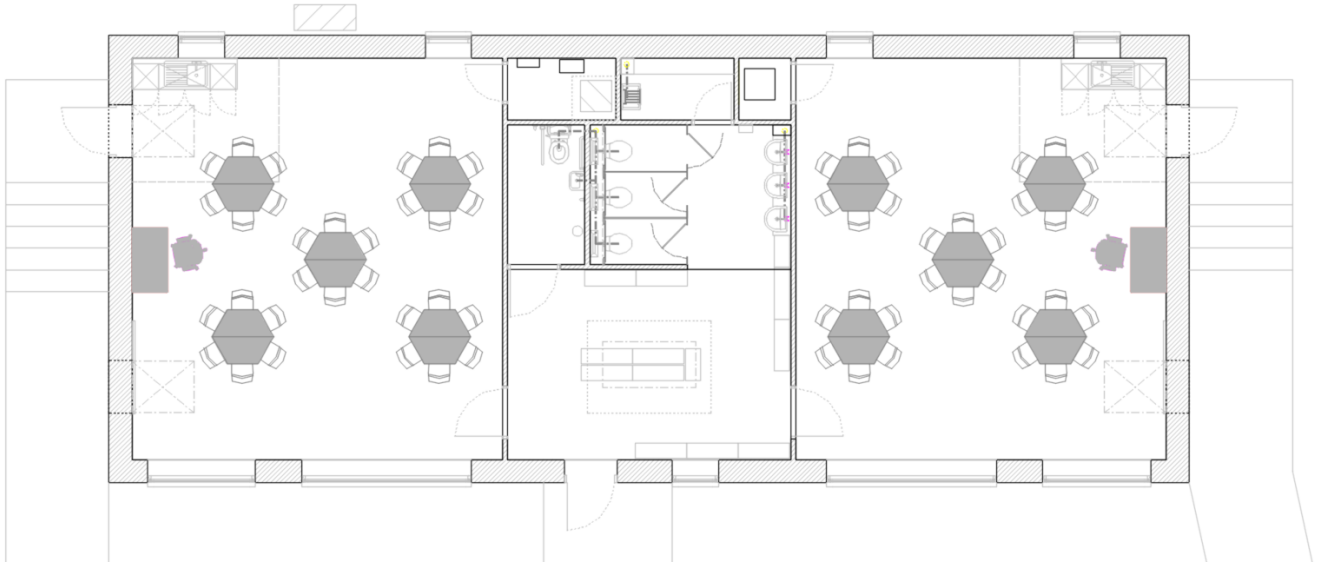

Figure 1-2 Proposed Classroom

2 Planning and Policy Considerations

2.1 National Planning Policy Requirements

2.1.1 National Planning Policy Framework (NPPF) and Planning Practice Guidance (PPG)

In recent years, the Government and local Councils have placed increased priority on the need for developers to take full account for the risks of their development at all stages of the planning process. The National Planning Policy Framework (NPPF) and Planning Practice Guidance (PPG) identifies how the issue of flooding is dealt with through the planning process and with the creation of a site-specific Flood Risk Assessment (FRA) for sites over 1ha in area or in Flood Zones 2 & 3.

2.1.2 DEFRA – Sustainable Drainage Systems

The Department for Environment, Food and Rural Affairs (DEFRA) national standards for sustainable drainage systems provides technical guidance on the design, construction and maintenance of Sustainable Drainage Systems (SuDS).

2.2 Cambridgeshire Flood and Water SPD

The Cambridge Flood and Water SPD discusses the importance of implementing SuDS at an early stage of design, and mimicking natural drainage to reduce the impact of the development proposal.

The policy provides the following drainage hierarchy:

- Store rainwater for later use;
- Use infiltration techniques, such as porous surfaces in non-clay areas;
- Attenuate rainwater in ponds or open water features for gradual release;
- Attenuate rainwater by storing in tanks or sealed water features for gradual release;
- Discharge rainwater direct to a watercourse;
- Discharge rainwater to a surface water sewer/drain;
- Discharge rainwater to the combined sewer.

2.2.1 Strategic Flood Risk Assessment

Fenland District Council commissioned a Level 1 Strategic Flood Risk Assessment in June 2022. The SFRA assesses the risk of flooding for proposed developments, including sequential test reviews against the Flood Zones Map.

3 Flood Risk Summary

A detailed site-specific Flood Risk Assessment (FRA) has been prepared by BOLD Environmental LTD (ref;3352_01) in October 2022. The FRA outlines the existing flood risk posed to the site, as well as evaluating how the proposed development will affect these risks.

The site is within Flood Zone 3.

The FRA indicates the maximum potential for Fluvial Flood Risk across the site to be a ‘Medium’ risk. The potential risk from surface and ground water flooding is ‘low’.

The report recommends the minimum FFL for the proposed classroom block is equivalent to the existing building.

4 Existing Drainage

4.1 Public Sewerage

Anglian Water serve as the local statutory undertaker for sewerage in the area of the proposed site. Asset mapping has been obtained for the site, this is summarised below.

A 150mm Anglian Water foul sewer bisects the application site from south to north and discharges to the public foul pump station located north of the site .

The nearest publicly maintained surface water sewers are within Fields View road to the north. Approximately 170m from the development.

Figure 4-1 shows an extract of the asset mapping, which is contained in **Appendix D** of this report.

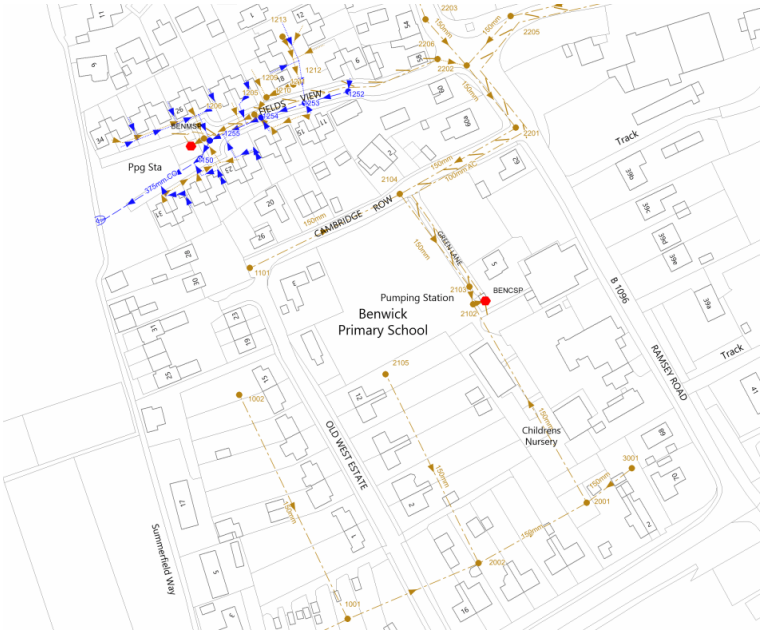

Figure 4-1 Anglian Water asset mapping

4.2 Private Drainage

A CCTV / GPR survey was undertaken by Survey Solutions in September 2022. This survey can be found in **Appendix E** of this report; a summary of the findings are indicated below.

4.2.1.1 Foul Water Sewers

The survey identified a number of foul runs within the site parcel which convey flows west towards the playfield. It is assumed that the foul drains positively to the Anglian Water pump station positioned just north of the site boundary, the full route would be surveyed to outfall prior to commencement of works, with remediation required where necessary.

4.2.2 Surface Water Drains

The survey indicated a number of rainwater pipes surrounding the main school building & temporary classroom. No surface water network was recorded on site and rainwater pipes were recorded to discharge to ground.

There is one manhole positioned centrally (denoted as “Surface Water Manhole” on Figure 4-3) within the site parcel denoted as surface water, both inlets and the outlet were recorded to be blocked. Should this manhole be correctly denoted as surface water it’s likely it drains to the private foul network.

There are two surface water networks within the site parcel adjacent to the southern boundary. An additional survey was undertaken to determine their routes to outfall in September 2023. The northern most surface water network conveyed flows west, under the existing nursery building, but the pipe was blocked. The second network was unable to be traced further due to a large silt building within the manhole, Figure 4-2 shows a photo of the blocked manhole.

Figure 4-2 Block manhole

Figure 4-3 shows an extract of the survey which is contained in **Appendix E** of this report.

Figure 4-3 GPR / CCTV Survey Extract

4.2.3 Land Drainage

There are no ditches operated by the internal drainage board (Benwick IDB) within vicinity of the application site, the nearest being approximately 400m north west, as shown in Figure 4-4.

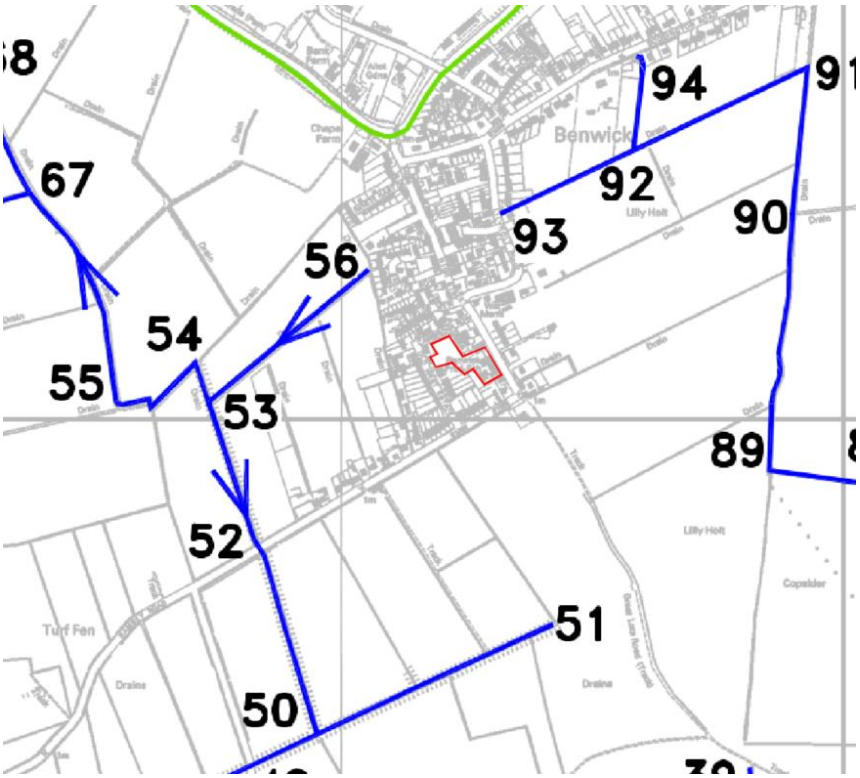

Figure 4-4 Benwick IDB extract

5 Proposed Drainage Strategy

5.1 General

The drainage strategy has been developed following meetings with Cambridgeshire County Council as the Lead Local Flood Authority (LLFA) in response to on-site discharge limitations.

In the absence of a more typical method of discharge, it was discussed in agreed with the LLFA that the proposed classroom block would discharge as the existing, i.e rainwater pipes discharging surface water onto the ground. In order to provide a degree of betterment, it has been proposed a rainwater garden / bioretention area will be utilised prior to discharge. Minutes from the two meetings with the LLFA are appended in **Appendix F** and **G** of this report.

5.2 Surface Water

In line with the Drainage Hierarchy, surface water runoff from a site should endeavour to be controlled as close to the source as possible. Discharge from site should be via one of the methods detailed in **Table 1**, in descending priority;

Table 1: Discharge Opportunities

London Sustainable Drainage Hierarchy	Site Specific Application
Store rainwater for later use	The feasibility of providing a waterbutt is limited due to the proposal of rain gardens, it is noted that runoff is proposed to exclusively discharge to this SuDS feature therefore providing irrigation.
Use infiltration techniques, such as porous surfaces in non-clay areas	As indicated in section 1.4 of this report, BRE 365 shallow soakaway testing was undertaken and recorded very poor results, **Appendix H** contains an email from the surveyor indicating no infiltration occurred during their testing.. The borehole undertaken also indicated ground water within the top of the permeable lens (Gravel), indicating disposal of surface water via infiltration (shallow or deep) would not be suitable. The EA recommend that the deep bore soakaways required a clearance of 1m from ground water. As noted above due to the proximity of the ground water this is not feasible.
Attenuate rainwater in ponds or open water features for gradual release	A rainwater garden has been proposed adjacent to the eastern face of the proposed building.
Attenuate rainwater by storing in tanks or sealed water features for gradual release	No geocellular tanks have been proposed.
Discharge rainwater direct to a water course	No water courses within vicinity of the application site. The closest water course is circa 400m northwest of the development due to third party land constraint it is not feasible to discharge to this.

London Sustainable Drainage Hierarchy	Site Specific Application
Discharge rainwater to a surface water sewer/drain	No surface water sewers/drains within vicinity of the application site. The CCTV survey indicates a surface water manhole on site, which likely conveys flows into the Anglian Water network. Discussions were held with Anglian Water who indicated notwithstanding any existing surface water connection to their foul network; no surface water from the proposed classroom could discharge into their foul sewer.
Discharge rainwater to a combined sewer	No combined water sewers within vicinity of the application site.

5.2.1 Proposed Site Discharge

As discussed in Section 5.1 and 5.2, discharge opportunities are limited, this was discussed and with the LLFA who also indicated this. As such it was agreed with the LLFA that surface water would following the existing surface water arrangement of discharging directly to ground. It is noted that the development proposal would involve a minor increase in impermeable area, from 183m^2 to 200m^2 (circa 10%).

To help control the flow of discharge to ground and provide treatment, rainwater pipes are proposed to discharge directly to rain gardens prior to discharging to ground. A drainage general arraignment can be found in **Appendix I** of this report.

A Causeway flow hydraulic model has been prepared to calculate the expected discharge from the new classroom. The model indicates it would likely discharge at 14.2 l/s during the 1 in 100 year plus 40% climate change storm event. This however does not consider the provision of a raingarden / bioretention area which the surface water would be conveyed through.

It is considered that the provision of the rain garden feature would provide sufficient flow restriction and attenuation to lessen the discharge rate when compared to the existing temporary structure. Figure 5-1 indicatively shows the the proposed raingarden, the standard detail is contained within **Appendix J** of this report.

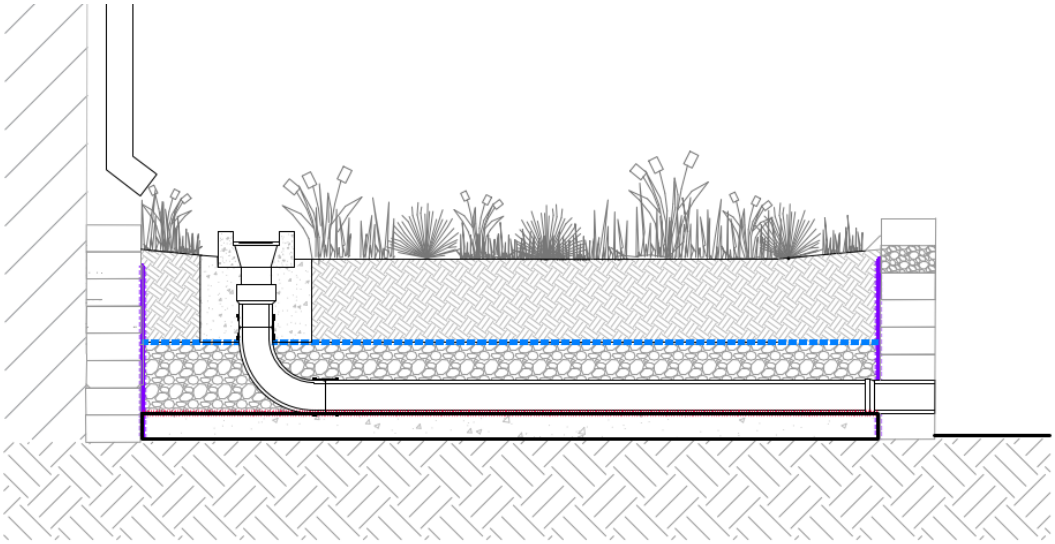

Figure 5-1 Rain Garden Detail

5.2.2 Sustainable Drainage Systems

Developments should utilise sustainable drainage systems (SuDS) unless there are practical reasons for not doing so. As mentioned previously, the design should aim to reduce run-off rates and ensure that run-off is managed as close to its source as possible as per the drainage hierarchy (see Table 1).

The SuDS Hierarchy sets out the preferred method of discharging and managing water from a development site and aims to highlight why each item has been utilised or discounted.

Table 2 analyses the SuDS hierarchy and the appropriate techniques with specific focus on this project.

Table 2: SuDS Opportunities

SuDS Technique	Site Specific Analysis
Rainwater Harvesting	The feasibility of providing a waterbutt is limited due to the proposal of rain gardens, it is noted that runoff is proposed to exclusively discharge to this SuDS feature therefore providing irrigation.
Living or Roofs/Areas	A bioretention area is proposed adjacent to the eastern face, so both attenuation and slow the discharge of water and providing a degree of cleansing.
Basins and Ponds	No basins or ponds are proposed Due to spatial constraints and the nature of the development being a primary school.
Filter Strips and Swales	No filter strips of swales are proposed.
Infiltration Devices	BRE 365 testing indicated the sub-strata is impermeable and ground water levels etc..

Permeable Surfaces	No external hardstanding is proposed therefore permeable paving cant be utilized.
Tanked Systems	No tanks are proposed.

5.2.3 Water Quality

The proposed drainage strategy manages pollution risk for the site based on a simple qualitative method as defined in the CIRIA SuDS Manual C753, consisting of an assessment of likely pollution hazard levels for the site and SuDS performance capacities:

Step 1. Allocate suitable pollution hazard indices for the proposed land use

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05

Figure 1: Extract of CIRIA SuDS Manual C753. Pollution Hazard Indices for Land Use Classification

Whilst the roof area could be considered more close to a residential roof, the Other roof category has been selected to provide a worst case scenario.

Step 2. Select SuDS with a total pollution mitigation index that is equal or exceeds the pollution hazard index.

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters

	Mitigation indices[1]		
Type of SuDS component	**TSS**	**Metals**	**Hydrocarbons**
Filter strip	0.4	0.4	0.5
Filter drain	0.4[2]	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond[4]	0.7[3]	0.7	0.5
Wetland	0.8[3]	0.8	0.8
Proprietary treatment systems[5,6]	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

*Figure **Error! No text of specified style in document.**-2: Extract of CIRIA SuDS Manual C753. Pollution Mitigation Indices*

5.2.4 Flood Exceedance

With the absence of surface water disposal methods, the drainage strategy proposed surface water is discharged onto the ground, in line with the existing scenario. It is therefore critical to ensure surface water is conveyed overground.

And overland exceedance plan has been prepared showing how surface water will be conveyed and is contained within **Appendix K** of this report. Figure 5-2 shows an extract.

Figure 5-2 Existing Overland Exceedance Routes

5.3 Foul Water

No uplift in foul water flows are anticipated as part of the proposals and the number of sanitary fittings is proposed to remain the same.

Foul water discharge generated by the proposed classroom would be conveyed into the private foul network within the playground that is thought to convey flows positively to the Anglian Water pump station. This follows the existing arrangement.

The full route to outfall is to be surveyed prior to construction.

6 General Maintenance

It is assumed that all drainage within the site will be maintained as a private network. A suitable maintenance strategy will be included within handover documentation by the contractor once final details and suppliers have been chosen for the individual drainage elements. This strategy should be adopted to ensure the drainage network is cleaned regularly and the routine maintenance and cleansing regime should be documented.

An Operation and Maintenance Manual has been written by Curtins and should be referenced for general maintenance, 81728-CUR-00-XX-RP-D-92004 this can be found in **Appendix L**.

7 Conclusions and Recommendations

This report is intended to provide further details on the design of the drainage systems for the proposed classroom block at Benwick Primary School and to act as additional information in support of the planning application. The conclusions to be drawn from this report are as follows:

- The development proposal consists of a new classroom block to replace the existing temporary one. The new classroom block has an impermeable area of 200m^2 which is approximately 10% greater than the existing (183m^2).
- The drainage strategy has been developed following meetings with the LLFA, and it has been agreed to follow the existing scenario, i.e. discharge to ground, with provision of a rainwater garden. The LLFA minutes are appended in this report.
- The overland exceedance routes have been plotted and indicate surface water would pond at an area within the site parcel and be conveyed to the playfield to the north west.
- The water treatment provided by the raingarden would provide sufficient cleansing in accordance with the CIRIA SuDS manual.
- A Flood Risk Assessment has been prepared by BOLD Geoenviromental and indicates the site is at risk of Fluvial Flooding, but not surface water or groundwater.

8 Appendices

Appendix A - Topographical Survey

Appendix B - Borehole Log

Appendix C - Masterplan

Appendix D - Asset Mapping

Appendix E - CCTV

Appendix F - First LLFA Meeting Minutes

Appendix G - Second LLFA Meeting Minutes

Appendix H – BRE 365 Testing Email

Appendix I - Drainage General Arrangement

Appendix J - Drainage Standard Details

Appendix K - Flood Exceedance Plan

Appendix L - Operations and Maintenance manual