



Project No

LE-161

Project

**Fredrick Finlay Care Home
38-54 Oxford Road, Dewsbury**

Title

Surface Water Management Report

Date

October 2023

Revision

B

This report has been prepared for the private and confidential use of Thomas Owen Care and cannot be reproduced in whole or in part or relied upon by any third party for any use whatsoever without the express written authorisation of CCS Consulting Limited. If any third party whatsoever comes into possession of this report, they rely on it at their own risk and CCS Consulting Limited accepts no duty or responsibility (including in negligence) to any such third party.

Author: Mark Symonds

Contents	Page
1. Introduction	3
2. Planning Policies and Guidance	4
3. Site Setting and Description	5
4. Surface Water Management Principles	6
5. Surface Water Run-Off Destination	8
6. SuDS Feasibility	9
7. Development Greenfield Run-Off Rates and Volume	12
8. Below Ground Drainage Networks and SW Management Calculations	14
9. Maintenance Requirements	17
10. Surface Water Design Exceedance	18
11. Water Quality	18
12. Development Management and Construction Phase	19
13. Conclusion / Summary	20

Appendices

Appendix A	-	Topographical Survey
Appendix B	-	Proposed Site Plan
Appendix C	-	British Geological Survey Data
Appendix D	-	Yorkshire Water Asset Plan
Appendix E	-	Greenfield Run-Off Rates and Volume Calculations
Appendix F	-	Below Ground Drainage Layout and Details
Appendix G	-	Surface Water Network / Management Calculations
Appendix H	-	Pollutant Control Chamber

1. Introduction

This surface water management report has been prepared by CCS Consulting, on behalf of Thomas Owen Care, in support of a full planning application for Frederick Finlay Care Home, Oxford Road, Dewsbury, West Yorkshire, WF13 4JR (hereafter referred to as the 'Site').

The report describes and demonstrates how the surface water run-off rate and volume from the Site will be managed to adhere to National and local policy, regulations, and relevant design guidance, which include:

- National Planning Policy Framework (NPPF), July 2021, Paragraphs 153-158 and 159-169;
- National Planning Practice Guidance (NPPG) ('Flood Risk and Coastal Change' section), released in March 2014 and updated in August 2022;
- National Standards for Sustainable Drainage Systems (SuDS) set out by the Department for Environment, Food & Rural Affairs (DEFRA) (2011);
- CIRIA (2010) Planning for SuDS – Making it Happen C687;
- CIRIA SuDS Manual C753 (2015);
- Kirklees Local Plan Strategy and Policies – Policy LP28 (Adopted February 2019);
- Kirklees Surface Water Management Plan (February 2011);
- Kirklees Local Flood Risk Management Strategy (February 2013).

Kirklees Council, acting as Lead Local Flood Authority (LLFA), need to be satisfied that the design and drainage principles of the Site will address the surface water management and risk of flooding within the Site; will ensure that the drainage is managed and maintained for its lifetime to prevent flooding; and will ensure that the Site will not increase the risk of flooding to neighbouring land and property.

The report is formatted such that it identifies and references appropriate design parameters, shows by calculation how the proposed drainage strategy can meet the various requirements and ultimately controls, mitigates and reduces future flood risk both on and off site.

2. Planning Policies and Guidance

2.1. National Planning Policy Framework (NPPF) and National Planning Practice Guidance (NPPG)

The NPPF (July 2021) sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally prepared plans for housing and other development can be produced. This document is used to form this surface water management report, with particular attention to Paragraphs 153 to 158 Planning for Climate Change.

NPPG, Paragraph 051 states that sustainable drainage systems (SuDS) are designed to control surface water run off close to where it falls and mimic natural drainage as closely as possible, where they provide opportunities to reduce the causes and impacts of flooding; remove pollutants from urban run-off at source; and to combine water management with green space with benefits for amenity, recreation, and wildlife.

Further to this NPPG, Paragraph 080 states that the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable which (in order) are into the ground (infiltration); to a surface water body; to a surface water sewer, highway drain, or another drainage system; to a combined sewer.

2.2. Flood and Water Management Act

The Flood and Water Management Act takes forward some of the proposals from three previous strategy documents published by the UK Government - Future Water (2008), Making Space for Water (2008) and the UK Government's response to the Sir Michael Pitt's Review of the summer 2007 floods. In doing so it gives the EA a strategic overview role for flood risk, and gives local authorities responsibility for preparing and putting in place strategies for managing flood risk from groundwater, surface water and ordinary watercourses in their areas.

2.3. Kirklees Local Plan Strategy and Policies

Policy LP28 states:

'The presumption is that Sustainable Drainage Systems (SuDS) will be used to assist in achieving the following on each site:

- a. for proposals on greenfield sites, typical greenfield run-off rates should not be exceeded;*
- b. for proposals on brownfield sites there should be a minimum 30% reduction in surface water run-off where previous positive surface water connections from the site can be proven. New connections will be subject to at least greenfield restrictions;*
- c. No negative impact on local water quality and improvements in water quality where practicable;*
- d. Consider whether proposed open spaces and green infrastructure within sites can contribute to the sustainable drainage of the site.*

Local conditions including the existence of critical drainage areas may require a lower run-off rate to be agreed to reflect volume control, local surface water risks, water course capacity and flood risk further downstream.

There will be a general presumption against pumping surface water. It must also be demonstrated that the surface water management solution is designed to meet requirements over the lifetime of the development including evidence that management and maintenance arrangements have been secured to cover that period. This includes ensuring proposals to store water meet national standards and latest best practice.

Flow paths accommodating water from outside the site or due to an exceedance event should be designed to avoid buildings and curtilages. Development will only be permitted if it can be demonstrated that the water supply and waste water infrastructure required is available or can be co-ordinated to meet the demand generated by the new development'.

3. Site Setting and Description

3.1. Site Location

The Site is in a residential area of Dewsbury, is approximately 1 km north-west of Dewsbury station, and is bound by Reservoir Street to the north, residential dwelling and gardens to the east and west, and Oxford Road to the south.

The nearest postcode to the site is WF13 4JR, with co-ordinates for the centre of the site being - Easting: 423350, Northing: 422150.

3.2. Existing Site and Topography

As detailed on the topographical survey plan in Appendix A, the Site is currently undeveloped and consists of trees, shrubs and grassed areas, and therefore is deemed to be greenfield.

The Site has a general fall in a southerly direction, where the levels range from approximately 116.10m AOD at the north-east boundary to approximately 112.90m AOD at the south-east boundary.

3.3. Proposed Development

The proposed site is shown on the development plans in Appendix B, with a full description of the Site being stated by the Architect. In brief, and in relation to this surface water management report, the proposed development is to build a new care home, with the main building to the centre, independent living units to the south, a service road to the north-west (access from Reservoir Street), parking to the south (access from Oxford Road), pedestrian / courtyard areas around the main building perimeter, a green courtyard area to the centre, and soft-landscaping throughout.

3.4. Ground Conditions

The ground conditions can be determined by the British Geological Survey (BGS) website, where it shows the Site to have no superficial deposits, and bedrock consisting of Emley Rock (sandstone). The BGS website also shows borehole log data 250m north and south of the Site, and within the same strata (see Appendix C), which shows the ground to predominantly consist of clay.

3.5. Waterbody / Rivers / Canals

There are no known waterbodies near the Site, with the nearest being the River Calder approximately 1km to the south, and the River Spen approximately 1.5km to the west.

3.6. On-Site Drainage and Public Sewers

As detailed on the Yorkshire Water asset plan in Appendix D, there are 375mm and 300mm surface and foul water sewers, respectively, in Reservoir Street (north), and 500mm and 300mm surface and foul water sewers, respectively, in Oxford Road (south).

As the Site is undeveloped, it is believed that there are no drainage networks within the development boundary.

3.7. Surface Water Management Areas

The Site boundary area is approximately **7,650m² / 0.765 ha**.

The pre-development surface water run-off from within the Site will discharge off the site at a greenfield rate, with an urban factor of 0.

Surface water run-off from the buildings, access road, car park, courtyards and footpaths equate to **4,050m² / 0.405 ha** and will form the surface water management area, with the surface water run-off from the green courtyard and soft-landscaping areas continuing to discharge off the site at a natural / greenfield rate.

4. Surface Water Management Principles

The surface water for the development site is to be managed so that it adheres to the current national regulations and local authority requirements.

4.1. Run-Off Destination

Surface water run-off is to discharge to one or more of the following in the order of priority shown:

- Discharge into the ground (infiltration);
- Discharge to a surface water body;
- Discharge to a surface water sewer, highway drain or other drain;
- Discharge to combined sewer.

4.2. The Management Train

A concept fundamental to implementing a successful SuDS scheme is the management train. This is a sequence of SuDS components that serve to reduce run-off rates and volumes and reduce pollution. The hierarchy of techniques that are to be used for the surface water management of the development are:

- Prevention - Prevention of run-off by good site design and reduction of impermeable areas;
- Source Control - Dealing with water where and when it falls (e.g. infiltration techniques);
- Site Control - Management of water in the local area (e.g. swales, detention basins);
- Regional Control - Management of run-off from sites (e.g. balancing ponds, wetlands).

4.3. Design Principles

The design principles for the surface water management of the development will be to:

- Ensure that people, property, and critical infrastructure are protected from flooding;
- Ensure that the development does not increase flood risk off site;
- Ensure that SuDS can be economically maintained for the development.

4.4. Peak Surface Water Flow

Non-Statutory Technical Standards for Sustainable Drainage Systems states:

S2 *For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100-year rainfall event should never exceed the peak greenfield runoff rate for the same event.*

Kirklees Local Plan Strategy and Policies - Policy LP28 states: *'for proposals on greenfield sites, typical greenfield run-off rates should not be exceeded'.*

Therefore, based on the guidance, the surface water run-off from the Site is not to exceed the equivalent greenfield rates.

4.5. Volume Control

National Non-statutory technical standards for sustainable drainage systems states:

S4 *Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100-year, 6-hour rainfall event should never exceed the greenfield runoff volume for the same event.*

S6 Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with S4 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.

4.6. Flood Risk within Development

National Non-statutory technical standards for sustainable drainage systems states:

'S7 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30-year rainfall event.

S8 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100-year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.

S9 The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100-year rainfall event are managed in exceedance routes that minimise the risks to people and property'.

4.7. Pollution / Water Quality

The SuDS design for the development site will ensure that the quality of any receiving water body is not adversely affected and preferably enhanced in accordance with Ciria SuDS Manual C753, Chapter 4.

4.8. Designing for Exceedance

The development site design will be such that when SuDS features fail or are exceeded, exceedance flows do not cause flooding of properties on or off site. This is achieved by completely containing the surface water within the drainage system (including areas designed to hold or convey water) for all events up to a 1 in 30-year event. The design of the site ensures that flows from rainfall more than a 1 in 100-year rainfall event are managed in exceedance routes that avoid risk to people and property both on and off site.

5. Surface Water Run-Off Destination

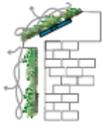
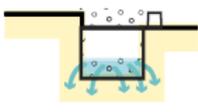
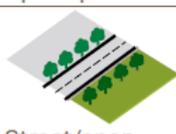
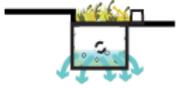
The destination of the surface water run-off from the post development site has been assessed against the prioritisation set by the Approved Document H (2010). The feasibility of the surface water run-off to the priority receptors are as follows:

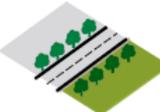
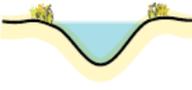
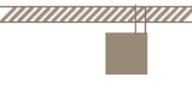
Run-Off Destination	Feasible / Required	Description
Discharge to Ground	No	The BGS borehole log data 250m north and south of the Site, and within the same strata shows the ground to predominantly consist of clay. Clay is known to have exceptionally low or no infiltration value and therefore discharge to ground is not feasible.
Discharge to Surface Water Body	No	There are no known surface waterbodies near to the development site, and therefore this is not a feasible discharge destination.
Discharge to Surface Water Sewer	Yes	As the ground is not feasible for infiltration, and there are no known waterbodies near the site, the only alternative is to discharge to a surface water sewer. The preferred surface water sewer is the 500mm diameter sewer in Oxford Road, and this is the lowest sewer in respect to the topography of the Site.
Discharge to Highway or Other Drain	No	There are no known highway drains near to the development site, and therefore this is not a feasible discharge destination.
Discharge to Combined Water Network	No	There is a 300mm combined water sewer in Levenshulme Road to the west of the Site. However, as it is feasible to discharge to the culverted watercourse, discharge to this sewer is not required.

6. SuDS Feasibility

To reduce the surface water run-off to the greenfield rate, SuDS methods are to be introduced to the post development design.

SuDS methods as per the Sustainable Drainage System (SuDS) hierarchy, and the Non-Statutory Technical Standards for Sustainable Drainage Systems – March 2015, that can be used are detailed below:

	Description	Setting	Required area
 <p>Green roofs</p>	A planted soil layer is constructed on the roof of a building to create a living surface. Water is stored in the soil layer and absorbed by vegetation.	 <p>Building</p>	Building integrated.
 <p>Rainwater harvesting</p>	Rainwater is collected from the roof of a building or from other paved surfaces and stored in an overground or underground tank for treatment and reuse locally. Water could be used for toilet flushing and irrigation.	 <p>Building</p>	Water storage (underground or above ground).
 <p>Soakaway</p>	A soakaway is designed to allow water to quickly soak into permeable layers of soil. Constructed like a dry well, an underground pit is dug filled with gravel or rubble. Water can be piped to a soakaway where it will be stored and allowed to gradually seep into the ground.	 <p>Open space</p>	Dependant on runoff volumes and soils.
 <p>Filter Strip</p>	Filter strips are grassed or planted areas that runoff is allowed to run across to promote infiltration and cleansing.	 <p>Open space</p>	Minimum length 5 metres.
 <p>Permeable paving</p>	Paving which allows water to soak through. Can be in the form of paving blocks with gaps between solid blocks or porous paving where water filters through the block itself. Water can be stored in the sub-base beneath or allowed to infiltrate into ground below.	 <p>Street/open space</p>	Can typically drain double its area.
 <p>Bioretention area</p>	A vegetated area with gravel and sand layers below designed to channel, filter and cleanse water vertically. Water can infiltrate into the ground below or drain to a perforated pipe and be conveyed elsewhere. Bioretention systems can be integrated with tree-pits or gardens.	 <p>Street/open space</p>	Typically surface area is 5-10% of drained area with storage below.

	Description	Setting	Required area
 <p>Swale</p>	Swales are vegetated shallow depressions designed to convey and filter water. These can be 'wet' where water gathers above the surface, or 'dry' where water gathers in a gravel layer beneath. Can be lined or unlined to allow infiltration.	 <p>Street/open space</p>	Account for width to allow safe maintenance typically 2-3 metres wide.
 <p>Hardscape storage</p>	Hardscape water features can be used to store run-off above ground within a constructed container. Storage features can be integrated into public realm areas with a more urban character.	 <p>Open space</p>	Could be above or below ground and sized to storage need.
 <p>Pond / Basin</p>	Ponds can be used to store and treat water. 'Wet' ponds have a constant body of water and run-off is additional, while 'dry' ponds are empty during periods without rainfall. Ponds can be designed to allow infiltration into the ground or to store water for a period of time before discharge.	 <p>Open space</p>	Dependant on runoff volumes and soils.
 <p>Wetland</p>	Wetlands are shallow vegetated water bodies with a varying water level. Specially selected plant species are used to filter water. Water flows horizontally and is gradually treated before being discharged. Wetlands can be integrated with a natural or hardscape environment.	 <p>Open space</p>	Typically 5-15% of drainage area to provide good treatment.
 <p>Underground storage</p>	Water can be stored in tanks, gravel or plastic crates beneath the ground to provide attenuation.	 <p>Open space</p>	Dependant on runoff volumes and soils.

The feasibility of the above SuDS methods for the post developed site are summarised in the table below:

SuDS Method	Feasibility	Description
Living Roofs	No	The proposed building roofs are pitched, and have not been structurally designed for living / green roof systems. Therefore, this is not a suitable SuDS method.
Rainwater Harvesting	Yes	The new dwellings and apartment building has not been designed for a dual pipe system to incorporate individual rainwater harvesting systems, as the water demand for the care home is to exceed the yield. However, water butts can be incorporated into some of the rainwater pipes, where the water can be used for irrigation.
Soakaway	No	The BGS borehole log data 250m north and south of the Site, and within the same strata shows the ground to predominantly consist of clay. Clay is known to have exceptionally low or no infiltration value and therefore discharge to ground is not feasible.
Filter Strips	Yes	Filter drains can be formed along the edge of the courtyard and footpaths around the perimeter of the main building. Surface water run-off from these areas will discharge to the

		<p>filter drain prior to discharge to main drainage network.</p> <p>The filter drain will be formed of a 300x300mm deep trench filled with 20mm no fines aggregate and wrapped in a permeable membrane. The trench will house a perforated pipe which will convey the surface water to the main network.</p> <p>The filter drain system will reduce the surface water run-off rates, and act as a pollutant control.</p>
Permeable Paving	Yes	<p>Permeable paving can be formed in the parking bays of the car park to the south of the site.</p> <p>The permeable surfacing will be formed over a 300mm deep sub-base consisting of 20mm no fines aggregate, which houses a perforated pipe to convey the surface water to the infiltration structure.</p> <p>The permeable surfacing system will reduce the surface water run-off rates, and act as a pollutant control.</p>
Swale / Shallow Pond / Bioretention Area	Yes	<p>The soft-landing areas throughout the site are relatively small, and will be used for new trees and planting. Therefore, there are no suitable areas within the site for swales, ponds, or bioretention areas.</p>
Hardscape Storage	No	<p>The external areas will be used for permeable paving or small footpath / courtyard areas, and therefore are limited areas for hardscape storage to be formed.</p>
Underground Storage	Yes	<p>The surface water run-off from the development site will be restricted to the equivalent greenfield rates.</p> <p>The restricted rate will be lower than the surface water run-off rate, therefore there will be a requirement to have further underground storage in the form of cellular units</p>

7. Development Greenfield Run-Off Rates and Volume

To minimise the surface water run-off from the Site, it is preferred that the post development surface water run-off be restricted to the equivalent greenfield run-off rate and volumes.

7.1. Greenfield Run-Off Rate

The Flood Estimation Handbook (FEH) is often used for the calculation of the greenfield run-off rate, however, relevant documents state that to calculate the greenfield run-off rates on small catchments less than 25km², the IH 124 QBAR equation (and the equation for the instantaneous time to peak for the unit hydrograph approach) is to be used. The IH method is based on the Flood Studies Report (FSR) approach and is developed for use on catchments less than 25km². It yields the Mean Annual Maximum Flood (QBAR). This reference also recommends the use Ciria C753 Table 24.2 to generate Growth Factors. These are used to convert QBAR to different return periods for different regions in the UK. The input variables to establish QBAR are:

Return Period (years)	Results based on a range of return periods and the specified RP;
Area	Catchment Area (ha) which is adjusted to km ² for use in the equation;
SAAR	Average annual rainfall in mm (1941-1970) from FSR figure II.3.1;
Soil	Procedure Volume 3. Soil classes 1 to 5 have Soil Index values of 0.15, 0.3, 0.4, 0.45 and 0.5 respectively;
Urban	Proportion of area urbanised expressed as a decimal;
Region Number	Region number of the catchment based on FSR Figure I.2.4.

QBAR(l/s)

The output variables to establish QBAR are calculated using the following formula (equation yields m³/s):

$$\text{QBAR} = 0.00108 \times \text{AREA}^{0.89} \times \text{SAAR}^{1.17} \times \text{SOIL}^{2.17}$$

The IH 124 Variables (taken from FSR) that are specific to this site are as follows:

Area	=	50.00 ha (required area for calculation)
SAAR	=	730
Soil	=	0.450
Urban Factor	=	0.00
Region Number	=	3

The calculations in Appendix E, show the rate for 50.00ha is 230.7 l/s, but is to be reduced to reflect the surface water management area (0.405 ha) of the development site. Therefore, the QBAR (greenfield run-off) for development area has been calculated to be:

$$\text{QBAR} = 1.87 \text{ l/s (4.61 l/s/ha)}$$

Ciria C753 Table 24.2 identifies the growth factors for each of the storm events, based on the known QBAR figure. The growth factors from the table vary depending on the site location. In this case hydrometric area (Region Number) is 3.

Based on the figures shown in the table, the growth factors, and the existing greenfield run-off rates for each of the storm events for the development areas of the site are as follows:

Storm Event	QBAR	Growth Factor (C753 Table 24.2)	Greenfield Run-off Rate
Q ₂	1.87 l/s	0.94	1.8 l/s
Q ₃₀	1.87 l/s	1.75	3.3 l/s
Q ₁₀₀	1.87 l/s	2.08	3.9 l/s

7.2. Greenfield Run-Off Volume

The greenfield run-off volume for the 100-year, 6-hour storm event has also been calculated in the MicroDrainage software using the data from the FEH 2013, with the results shown in Appendix E.

The FEH 2013 data and variables used to calculate the greenfield run-off volume at the Site location area as follows:

Site Location	=	GB 423351 422149 SE 23351 22149
Area	=	0.405 ha
SAAR	=	715
CWI	=	106.935
SPR Host	=	47.000
URBTEXT	=	0.00

Based on these calculation results (Appendix E), the greenfield run-off volume for the surface water management area of the Site is:

$$Q_{100(6\text{-Hour})} = \mathbf{116.58\text{m}^3} \text{ (287.87m}^3\text{/ha)}$$

8. Below Ground Drainage Networks and SW Management Calculations

8.1. Climate Change Allowance

The NPPF makes it a planning requirement to account for climate change in the proposed design. The recommended allowances are taken from the Environment Agency guidance summarised in Figure 1 below.

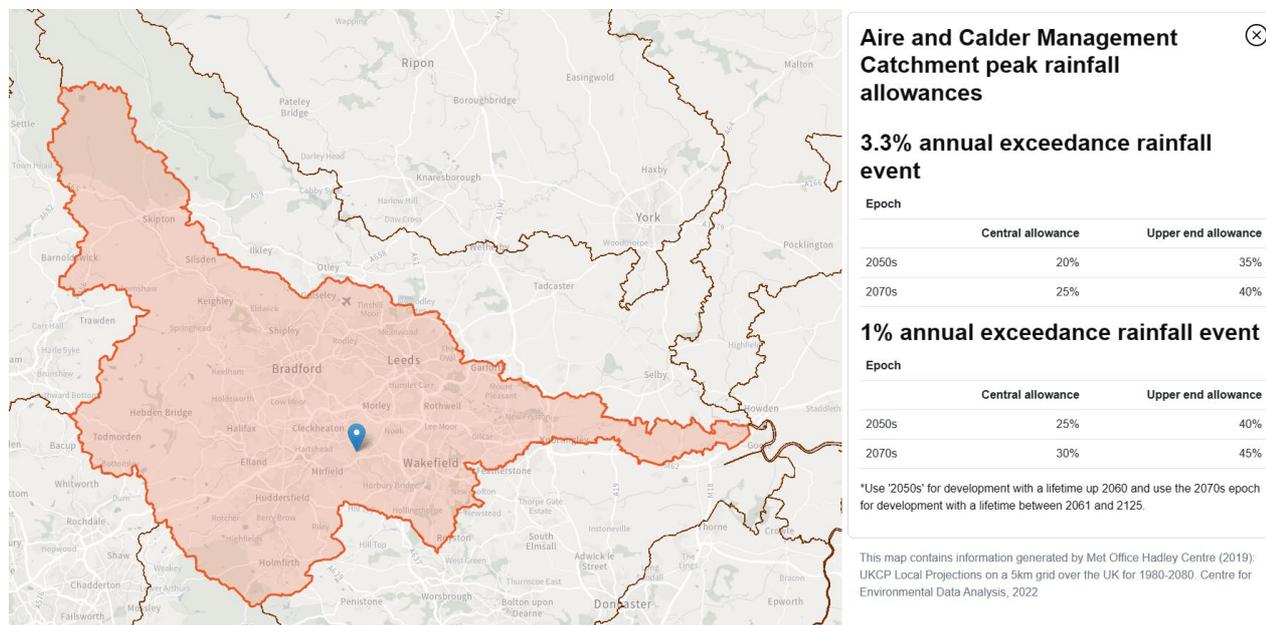


Figure 1 - Department for Environment Food & Rural Affairs – Climate Change Allowances

The lifetime of the extension is likely to be beyond 2061, and therefore the Epoch 2070's is to be used with Upper End Allowance. Therefore, the climate change allowance for the pre and post development surface water run-off will be **40%** and **45%** for the 30-year and 100-year storms, respectively.

8.2. Surface Water Network Calculations

The calculations to determine the post development surface water run-off rates are based on the surface water run-off area of 0.376 ha, and the rainfall data given by the FEH 2013.

8.3. Surface Water Drainage Network and Management

As shown on the below ground drainage layout drawing in Appendix G, the proposed surface water main network will consist of 150mm to 300mm diameter pipes, 460mm inspection and silt trap chambers, 1200mm diameter manholes; permeable paving; filter drains; swales / shallow ponds, a 1200mm diameter flow control chamber containing a hydro-brake; a pollutant control chamber, and an attenuation tank in the form of cellular units.

The surface water run-off from the new roof areas will discharge to the main network via rainwater pipes with trap gullies and water butts; the surface water run-off from the car park will discharge to the main drainage via permeable paving, and the surface water run-off from the footpath, courtyard and service road areas will discharge to the main drainage via the filter drains.

The surface water network will flow towards the southern boundary of the site, and will discharge through the flow control and pollutant control chamber prior to connection / discharge to the existing 500mm diameter surface water sewer in Oxford Road.

The surface water will surcharge the drainage network when being restricted, and will surcharge back into the upstream network, cellular units and swale / shallow pond, where the water will be stored to prevent flooding.

8.4. Surface Water Run-Off Rate

For the surface water run-off from the development site to be at the greenfield run-off rate, they are to be restricted to 1.8 l/s for the 1 in 2-year storm event; 3.3 l/s for the 1 in 30-year storm event + 40% climate change, and 3.9 l/s for the 1 in 100-year storm event + 45% climate change.

To achieve the equivalent greenfield run-off rates, it is proposed to use a complex flow control chamber, where a hydro-brake at the invert level of the chamber will restrict the surface water during 1-year storm event, and an orifice plate set higher in the chamber, will allow additional surface water flow from the chamber during the 100-year + 40% climate change storm events.

As shown in the output calculation from the MicroDrainage computer software in Appendix G, if the hydro-brake opening is set at 65mm, with a design head of 0.90m, and a design flow of 1.8 l/s (2-year greenfield rate), and an orifice is set 1.20m above the hydro-brake with a 57mm opening, the maximum surface water run-off rates for each storm event will be as follows:

Strom	-	Rate	-	Critical Storm Event
Q ₂	-	1.8 l/s	-	360-minute winter storm duration
Q _{30 + CC}	-	1.9 l/s	-	600-minute winter storm duration
Q _{100 + CC}	-	3.9 l/s	-	600-minute winter storm duration

A summary of the post development surface water run-off rates compared to the greenfield rates are as follows:

Greenfield Rate to Post Development Rate

Strom	-	Greenfield	-	Post Dev	-	Difference
Q ₂	-	1.8 l/s	-	1.8 l/s	-	Equivalent
Q ₃₀	-	3.3 l/s	-	1.9 l/s	-	42% Reduction
Q ₁₀₀	-	3.9 l/s	-	3.9 l/s	-	Equivalent

The results show that the post development run-off rates are equivalent to the 2-year and 100-year greenfield rate rates, and a 42% reduction of the 30-year greenfield rate.

Therefore, as the greenfield rates have not been exceeded, the discharge rates are deemed to be acceptable, as they still meet the requirements set out in the DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems – S2 and Kirklees Local Plan Strategy and Policies - Policy LP28 (see Section 4.4).

8.5. Surface Water Run-Off Volume

The surface water run-off volumes for the post development site have also been calculated for 1 in 100-Year the 6-hour duration (Inc. 45% CC), using the peak surface water discharge rate, whereas detailed in the MicroDrainage calculation in Appendix G, where the volume equates to:

$$Q_{100 (6-Hour)} = 3.9 \text{ l/s} \times (60 \times 60 \times 6) = 84,2400 \text{ litres} = 84.24\text{m}^3$$

A summary of the post development run-off volumes compared to the greenfield volume is as follows:

Greenfield Volume to Post Development Volume

Strom	-	Greenfield	-	Post Dev	-	Difference
Q ₁₀₀	-	116.58m ³	-	84.24m ³	-	28% Reduction

The post development surface water run-off volume is a 28% reduction of the greenfield volume for the same storm event and duration. Therefore, the discharge volume is deemed to be acceptable, as it meets the requirements set out in the DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems – S4 (see Section 4.5).

8.6. Surface Water Attenuation Calculations

As stated above, the post development run-off rates are restricted, there will be a requirement for surface water attenuation.

Ciria SuDS Manual 2015, Paragraph 10.2.4 states that: *‘Exceedance flows (i.e. flows in excess of those for which the system is designed) should be managed safely in above-ground space such that risks to people and property are acceptable’.*

Attenuation structure formed of below ground attenuation tank (cellular units).

As detailed in the MicroDrainage calculations (Appendix G) and below ground drainage strategy layout (Appendix F) the attenuation volumes and details for this SuDS method is as follows:

Cellular Units

Attenuation Tank Length	-	46.00m
Attenuation Tank Width	-	5.00m
Attenuation Tank Area	-	230.00m ²
Attenuation Tank Depth	-	1.20m
Attenuation Tank Volume	-	276.00m ³
Tank Porosity	-	0.95
Attenuation Volume	-	262.20m³

The MicroDrainage calculations (Appendix G) show that with this SuDS method / volume, no flooding will occur for all storms up to and including the 100-year + 45% storm event. Therefore, the attenuation volume is deemed to be acceptable, as it meets the requirements set out in the DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems – S7-S9 (see Section 4.6).

9. Maintenance Requirements

The management and maintenance of the surface water drainage networks and SuDS features will be undertaken by caretakers / grounds staff of the care home site, which will be appointed by the care home site owners (currently Thomas Owen Care).

The management and maintenance of the drainage and SuDS features will be included on the general management duties of the entire site (e.g. landscaping, gardening cleaning, etc), and will be carried out as follows:

9.1. Surface Water Drainage Network, Flow Control and Cellular Units

Operation	Frequency
Inspect and identify any areas that are not operating correctly, if required, take remedial actions	Monthly for 3 months, then six monthlies
Debris removal from manholes (where may cause risk performance)	Monthly
Where rainfall into network from above, check surface or filter for blockage or silt, algae, or other matter by jetting	As required, but at least twice a year
Remove sediment from pipework by jetting.	Annually or as required
Repair/check all inlets, outlets, and overflow pipes	As required
Inspect/check all inlets, outlets, and overflow pipes to ensure that they are in good condition and operating as designed	Annually and after large storms

9.2. Permeable Paving and Filter Drains

Operation	Frequency
Inspect and identify any areas that are not operating correctly, if required, take remedial actions	Monthly for 3 months, then six monthlies
Debris removal from on surface of filter drain and permeable paving or near system (where may cause risk performance)	Monthly
Rainfall infiltration into permeable paving and / or filter drain is ensured working effectively.	As required, but at least twice a year

9.3. Linked and Further Maintenance Activities

The maintenance of the drainage network and SuDS features are to be linked with the wider site maintenance for the new residential landscaped / garden areas.

A log of all maintenance activities is to be kept and made available to the local planning authority (LPA) and / or the Lead Local Flood Authority (LLFA) on request.

10. Surface Water Design Exceedance

In the unlikely event of an extreme storm greater than 100-year + 45% climate change, or poor maintenance of the SuDS features and / or pipework, potential flooding of the drainage network could occur.

Surface water flow paths to follow existing and proposed ground topography, where water will flow towards the south-east boundary and into Oxford Road.

Flood water will flow away from the proposed buildings and will not flow directly towards existing dwellings / properties outside the development boundary prior to discharge to Oxford Road. The flood water within the road will be contained due to the road having a gradient (water to flow along road) and upstand kerbs. Therefore, no increase in flood risk to other areas outside the development in a design exceedance event.

11. Water Quality

The level of water treatment is to be assessed against the details set out in Ciria SuDS Manual C753. Chapter 26 sets out the Pollution Hazard Indices for different land classifications, and how to calculate that against the SuDS mitigation indices to show suitable levels of treatment.

11.1. Building Roof, Service Road, Car Park Courtyard and Footpath Areas - Pollutant Hazard

C753 Table 26.2 Pollution Hazard Level = Low to Medium

C753 Table 26.2 Pollution Hazard Index:

Total Suspended Solid (TSS)	=	0.7
Metals	=	0.6
Hydrocarbons	=	0.7
Pollution Hazard Index	=	2.00

11.2. Access Road, Parking, Driveway, Footpath and Patio Areas - Pollutant Mitigation

Mitigation Measures:

Filter Drain, Permeable Paving and Pollutant Control Chamber

Pollutant Control Chamber Mitigation Indices (see Appendix H):

Total Suspended Solid (TSS)	=	0.8
Metals	=	0.8
Hydrocarbons	=	0.8
SuDS Mitigation Indices	=	2.40

If a pollutant control chamber is installed prior to discharge to the 500mm diameter surface water sewer, the mitigation indices will be greater than the pollution hazard index, and therefore suitable water quality will be achieved.

12. Development Management and Construction Phase

All existing drainage networks within the development area are to be maintained during construction. The pipe network, cellular units, flow control chamber and pollutant control chamber are to be the first part of the drainage network to be built. This will ensure that the surface water discharge is suitably restricted without pollutants or flooding.

12.1. Construction Environment Management Plan

Full details of the construction environment management plan (CEMP) have to be confirmed by the chosen contractor who has been appointed for the development. Therefore, it is recommended that this is a planning condition, with the assurance that a CEMP will confirm to the requirements of CIRIA 753 – The SuDS Manual – Chapter 31. The construction programming for SuDS, however, for the development site will include:

12.2. Construction Access

The main construction traffic will access the site from Oxford Road to be south of the Site, and will ensure that traffic over the proposed cellular units will be avoided.

12.3. Sediments and Traps

Sediment basins and traps are to be installed before any major site earthworks take place, with further sediment traps and silt fences being installed as the earthworks progresses. This will keep sediment contained on site at appropriate locations.

12.4. Run-Off Control Measures

Run-off control measures are to be used in conjunction with sediment traps to divert water around planned earthworks areas to remove silts. Any surface water upstream of the site is to be diverted around the development areas, and to discharge to the existing surface water sewer. The surface water run-off destination for the diverted surface water will continue as existing.

12.5. Main Surface Water Run-Off Systems

The main drainage network, cellular units, flow control chamber, pollutant control chamber and outfall to the surface water sewer are to be built prior to any phase of construction of site. Surface water from each of the phased areas is discharged to the new drainage network, where the water is adequately restricted, and water quality maintained before discharging to the culverted watercourse. Temporary inlet and outlet protection measures and appropriate silt traps are to be installed to prevent silt ingress into the main drainage network.

12.6. Clearing and Earthworks

Clearing and earthworks will only start when adequate erosion and sediment control measures are in place. Once the development areas are cleared, earthworks will follow immediately to ensure that the ground cover can be re-established quickly. Adjacent land to that being developed will be left undisturbed for as long as possible.

12.7. Surface Stabilisation Measures

Surface stabilisation measures will be applied to completed areas, channels ditches and other disturbed areas after the land is cleared and profiled. Permanent stabilisation measures will be installed as soon as possible after final profiling.

12.8. Construction of Permeable Surfacing

Construction of permeable paving is to be left to the later stages of construction. Unsuitable sediment is to be removed from surfacing prior to installation of sand binder layer and paving.

13. Conclusion / Summary

13.1. SuDS Principles and Discharge Destination

All feasible SuDS methods, and surface water discharge destination have been assessed, with the feasible SuDS methods being water butts, permeable paving, filter drains, swale / shallow pond, cellular units, a pollutant control chamber, and a flow control chamber, with the surface water destination being to a surface water sewer.

13.2. Peak Flow Control

the post development run-off rates are equivalent to the 2-year and 100-year greenfield rate rates, and a 42% reduction of the 30-year greenfield rate.

Therefore, as the greenfield rates have not been exceeded, the discharge rates are deemed to be acceptable, as they still meet the requirements set out in the DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems (S2) and Kirklees Local Plan Strategy and Policies - Policy LP28.

13.3. Volume Control

The post development surface water run-off volume is a 28% reduction of the greenfield volume for the same storm event and duration. Therefore, the discharge volume is deemed to be acceptable, as it meets the requirements set out in the DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems (S4)

13.4. Flood Risk within the Development

With the attenuation tank SuDS method / volume, no flooding will occur for all storms up to and including the 100-year + 45% storm event. Therefore, the attenuation volume is deemed to be acceptable, as it meets the requirements set out in the DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems (S7-S9).

13.5. Maintenance

The management and maintenance of the surface water drainage networks and SuDS features will be undertaken by caretakers / grounds staff of the care home site, which will be appointed by the care home site owners (currently Thomas Owen Care). The management and maintenance of the drainage and SuDS features will be included on the general management duties of the entire site (e.g. landscaping, gardening cleaning, etc.),

13.6. Surface Water Design Exceedance

Surface water flow paths to follow existing and proposed ground topography, where water will flow towards the south-east boundary and into Oxford Road. Flood water will flow away from the proposed buildings and will not flow directly towards existing dwellings / properties outside the development boundary prior to discharge to Oxford Road. The flood water within the road will be contained due to the road having a gradient (water to flow along road) and upstand kerbs. Therefore, no increase in flood risk to other areas outside the development in a design exceedance event.

13.7. Water Quality

The level of water treatment is to be assessed against the details set out in Ciria SuDS Manual C753. Chapter 26 sets out the Pollution Hazard Indices for different land classifications, and how to calculate that against the SuDS mitigation indices to show suitable levels of treatment. If a pollutant control chamber is installed prior to discharge to the 500mm diameter surface water sewer, the mitigation indices will be greater than the pollution hazard index, and therefore suitable water quality will be achieved.

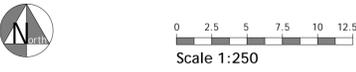
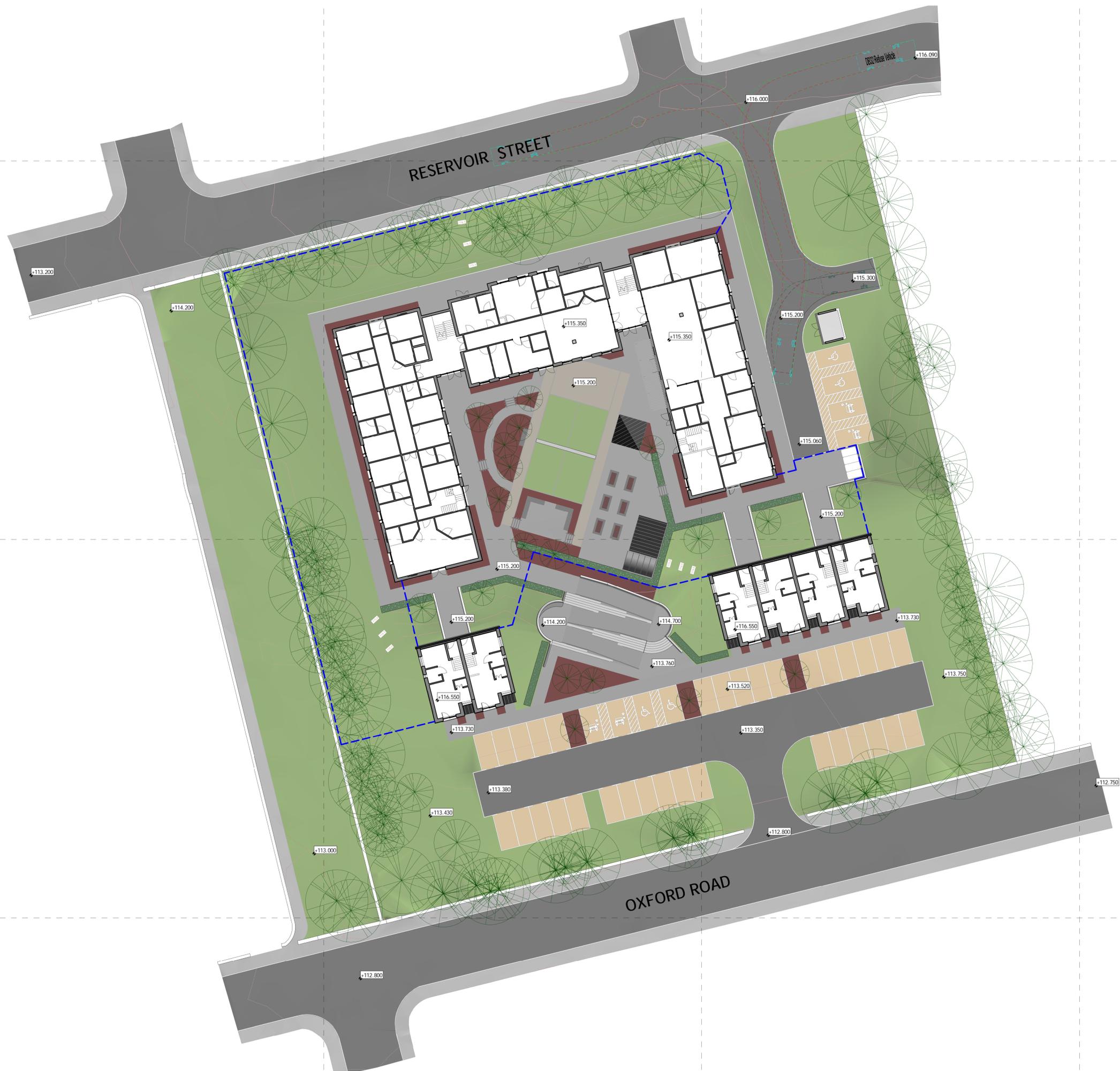
Appendix A

Topographical Survey

Appendix B

Proposed Site Plan

FARRELL & CLARK LLP © Do not scale from this drawing			
Rev.	Description	Date	By
P02	Site levels and Refuse/emergency access swept paths added.	03/10/23	AMN



Farrell & Clark Architects

LEEDS: 0113 259 0922, Leeds@farrellandclark.co.uk
 LONDON: 0207 580 9210, London@farrellandclark.co.uk
 www.farrellandclark.co.uk

Status:	PLANNING	A3
Client:	Thomas Owen Care	
Project:	Fredrick Finlay Oxford Road, Dewsbury	
Title:	Proposed Site Plan	
Drawn:	AMN	Date: June 2023
Check:	NC	Scale: 1 : 250 @A1
Information Name:	410004-FCA-01-00-DR-A-	0710 P02

SITE PLAN
1 : 250

Appendix C

British Geological Survey Data



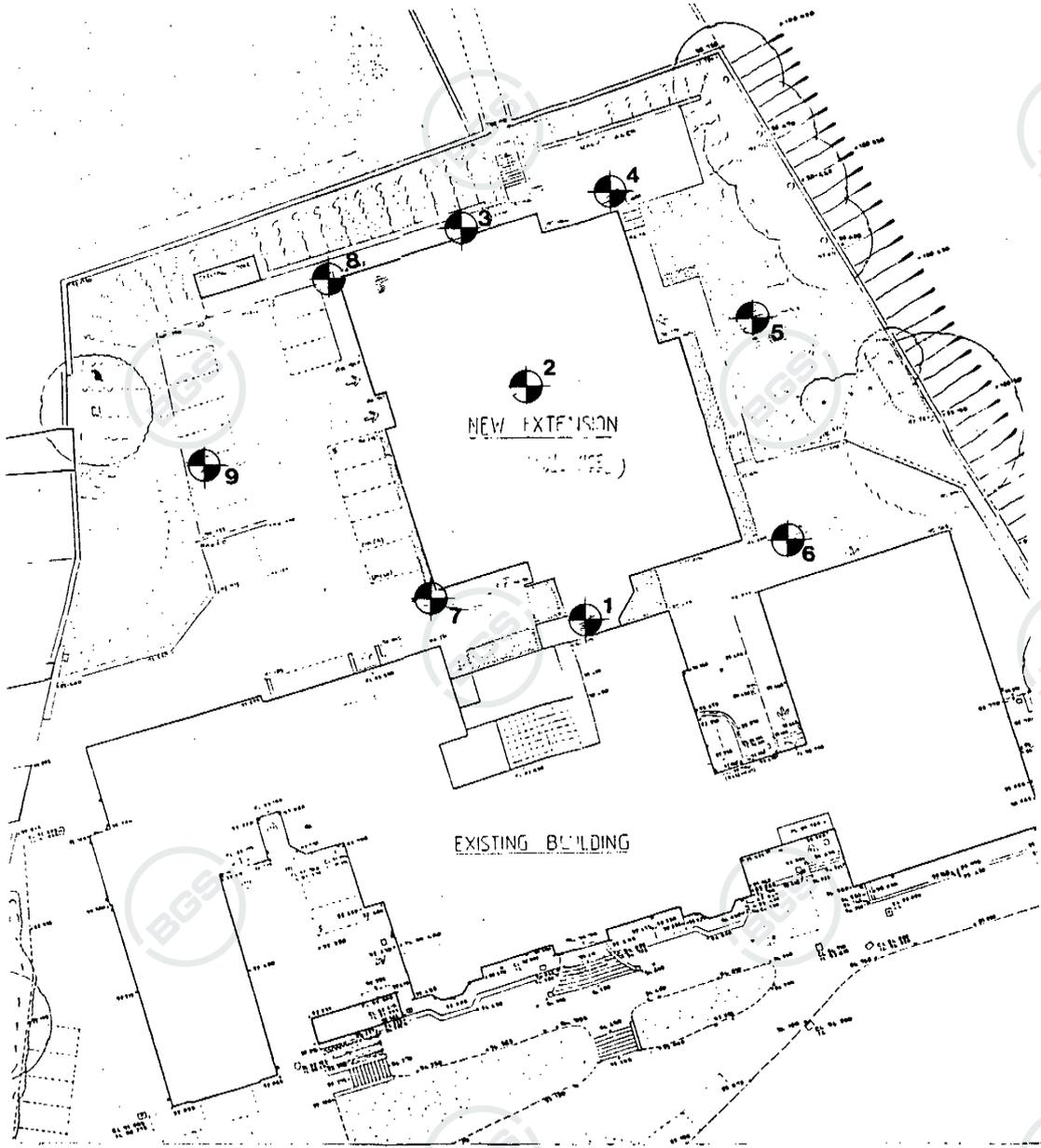
Norwest Holst Soil Engineering Ltd.							Borehole No. 9
Contract No. F7395		BOREHOLE LOG		SE 22SW 530			
Location Dewsbury Dabtac				Sheet 1 of 1			
Client Kirklees Metropolitan Council				Chainage			
Method of Boring Percussion				Ground Level		m.A.O.D.	
Diameter of Borehole 150mm		2371 2251		Date		21/4/87	
Description of Strata	Legend	Depth Below G.L. (m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/R.O.D.%	Daily Progress
TOPSOIL		0.40			0.40		
Very weak orange brown very thinly laminated slightly silty very highly weathered MUDSTONE lithorelics in soft light grey clay ...becoming indistinctly very closely to extremely closed fissured and moderately to highly weathered	x				(35)		
	x				1.40	(70)	
Weak to moderately weak green brown very thinly laminated extremely closely fissured silty MUDSTONE, with Fe stained bedding and fissure surfaces	x	2.30			2.30		
	x					"66"	
Moderately weak to strong light grey and orange brown thinly to thickly laminated silty fine SANDSTONE	x	3.50			3.50		
	x	4.10				50 for 50mm	

<p style="text-align: center;">Type of Sample</p> <p>S.P.T. Undisturbed</p> <p>C.P.T. X Vane</p> <p>Jar Δ Water</p> <p>Bulk Piezometer</p>	<p>Remarks (Observations of Ground Water etc.) () U100 blows</p> <p>Chiselling : 3.50m - 4.10m 1½ hours</p> <p>Groundwater not encountered</p> <p style="font-size: small;">Water levels are subject to seasonal or tidal variations and should not be taken as constant</p>
---	--

SE22SW/S22-530

Norwest Holst Soil Engineering Ltd

Client: Kirklees Metropolitan Council *Location:* Dabtac Dewsbury



N.B. Positions of Boreholes and/or Trial Pits are only indicative unless dimensioned.

Contract No. F7395	GROUND INVESTIGATION	Fig No.
Scale NTS	BOREHOLE LOCATION PLAN	1



Norwest Holst Soil Engineering Ltd.

Borehole No. **6**

Contract No. F5702 **BOREHOLE LOG** Sheet 1 of 1
 Location Birkdale School, Dewsbury Chainage.....
 Client Kirklees Metropolitan Council SE22SW 487 Ground Level..... m.A.O.D.
 Method of Boring Percussion 23535 22539 Date 24-25/8/83
 Diameter of Borehole 150mm

Description of Strata	Legend	Depth Below G.L. (m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/R.O.D.%	Daily Progress
MADE GROUND: Bituminous surfacing and hardcore.		0.50					
Brown mottled silty sandy CLAY.		2.00		150mm to 1.50m	1.00	(60)	
Dark grey to black very weathered shaly MUDSTONE, becoming less weathered and with iron-staining.		3.00			2.00	(60)	
End of borehole.					3.00	50 for 66mm	

<p>Type of Sample</p> <p>Is S.P.T. Undisturbed</p> <p>Ic. C.P.T. Vane</p> <p>O Jar Water</p> <p>● Bulk Piezometer</p>	<p>Remarks (Observations of Ground Water etc.)</p> <p>Borehole dry. Chiselling mudstone 2.50m to 3.00m.</p>
---	---



LOCATION EIGHTLANDS, DEWSBURY

SE 22 SW 610

TRIAL PIT 12

Method ~~Mechanical~~ Excavator

Date 19.7.78

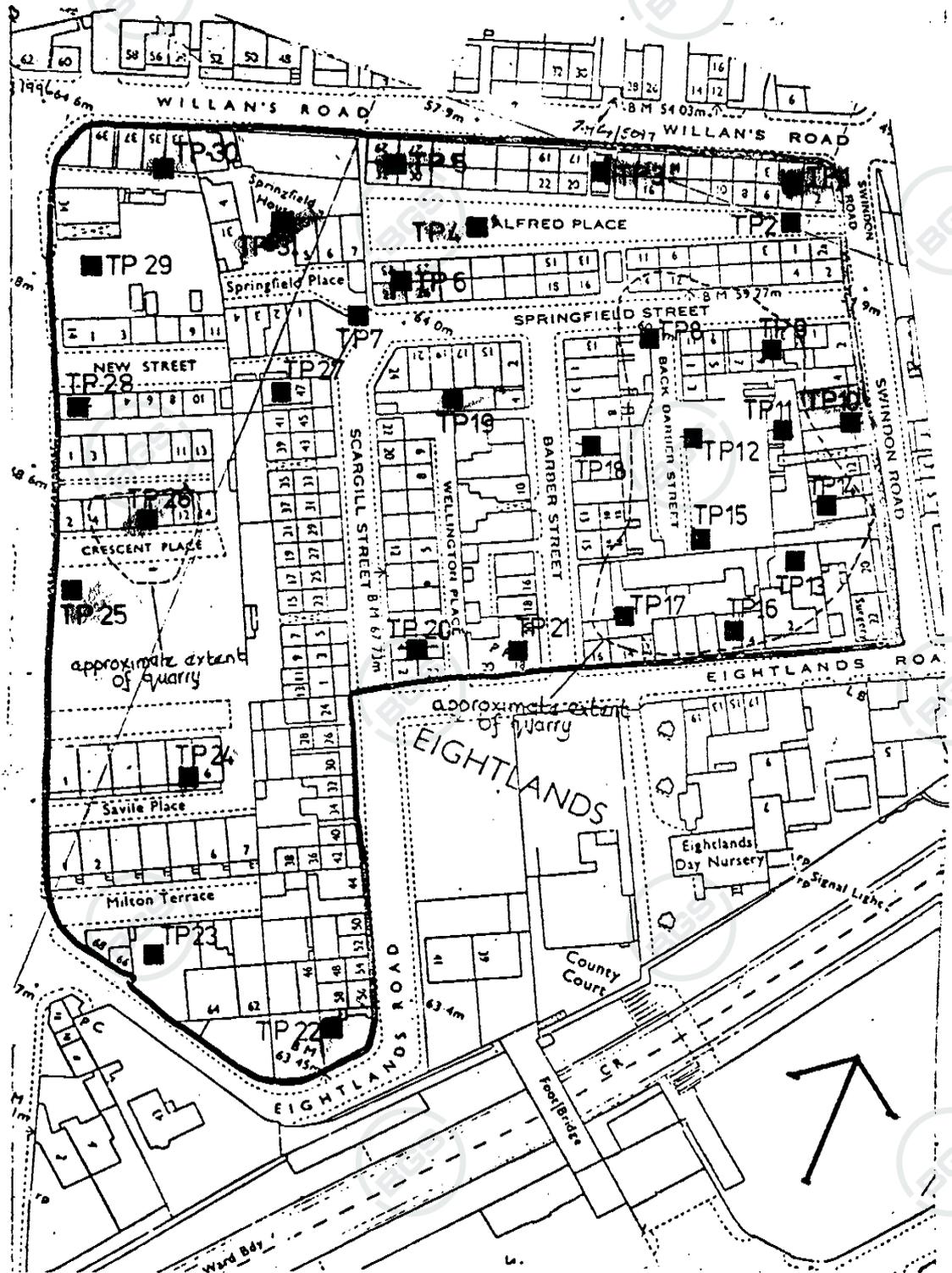
Casing

2429 2194

Sheet 1 of 1

R.L. m A.O.D.	DEPTH m	SOIL DESCRIPTION	SAMPLING		TEST	RESU
			No.	Depth		
	G.L.					
	0.5	MADE GROUND: Bricks, topsoil, sandstone, occasional wood, etc.				
	1.4	MADE GROUND: Angular sandstone fragments, generally cobble and boulder size with some clay. Not particularly voidy.				
	2.1	MADE GROUND: Loose purple ash.				
	3.6	(MADE GROUND): Angular sandstone fragments, cobble and boulder size, with some clay.				
		End of trial pit. Trial pit was dry.				

SE22SW/599-629



TRIAL PIT LOCATION PLAN

Scale 1:1250

FIGURE 2



SE22SW 757-T15

18126.rpt
14 January 1994

S DT

**Geotechnical Appraisal
for land at
Dewsbury Hospital**

**prepared for
Redrow Homes (Yorkshire) Limited**

**Robinson Fletcher Consultants Limited
South Barn
Midgeley Lane
Goldsborough
Knaresborough
HG5 8NJ**



Contract : DEWSBURY HOSPITAL.
Client : Redrow Homes (Yorkshire) Limited.
Coordinates :
Dates : 7/12/93 **SE22SW 758**
2377 2212

Equipment and Methods : Rotary openhole drilling using 100mm rock bit and air flush.
Job Number : 18126
Borehole Number : 2
Location : Dewsbury.
Orientation : Vertical
Ground Level :

Daily Prog.	Water Level	In-Situ Tests	TCR	SCR	ROD	FI	Core Run	Depth m	Strata Description	Red. Level	Legend
								0.00	Tarmac/bricks (MADE GROUND).		
								0.30	Yellow and brown weathered SANDSTONE.		
								(2.20)			
								2.50			
								(6.40)	Grey MUDSTONE.		
								2.90	Grey occasionally black MUDSTONE.		
								(2.70)			
								5.60	Loose drilling. NO RETURNS.		
								(5.60)			
								7.40	Grey MUDSTONE.		
								(5.90)			
								9.30	Grey SANDSTONE.		
								(5.70)			
								10.00	Borehole Continued		

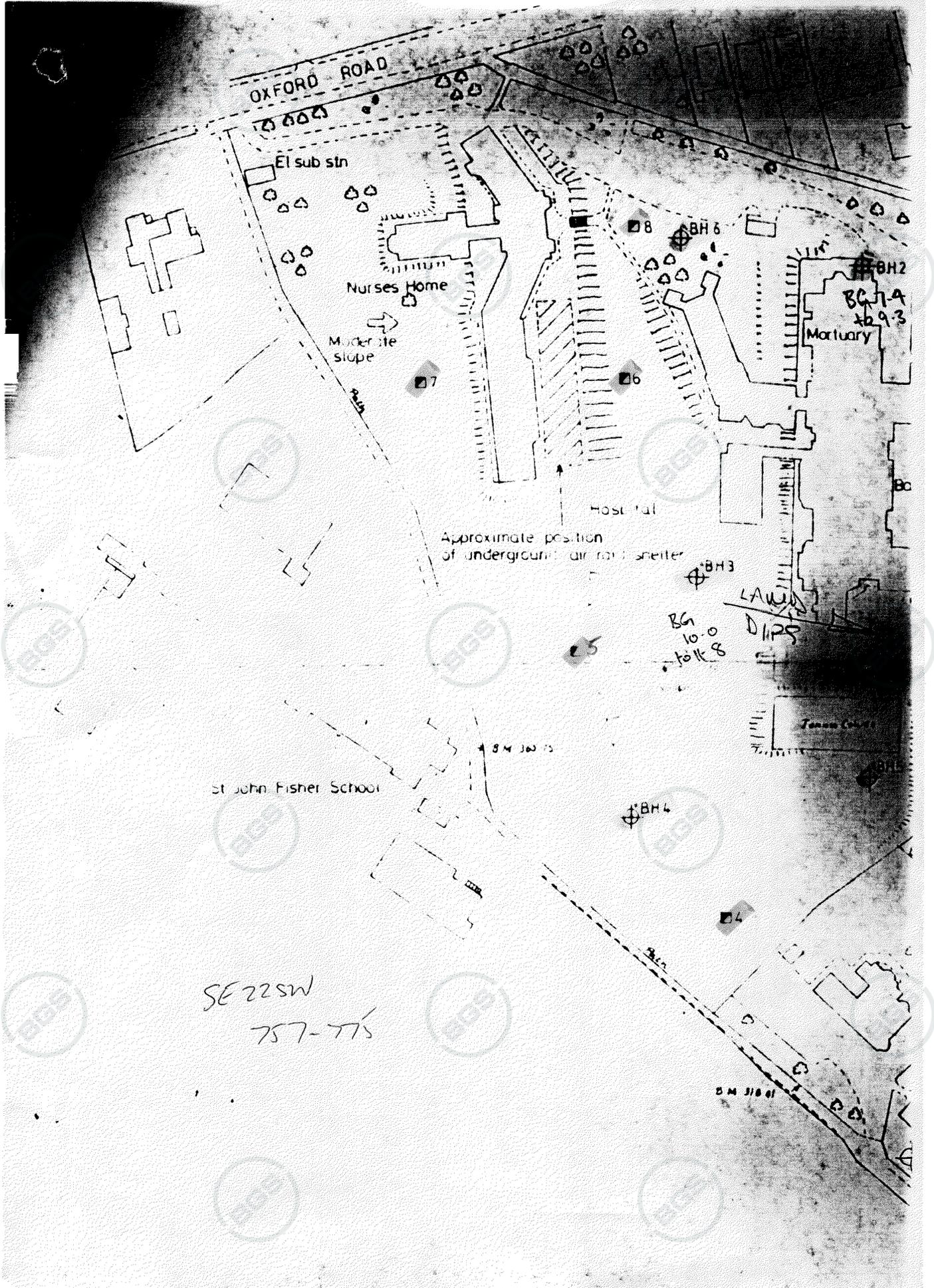
Key :
 In-Situ Tests
 S SPI Value
 C CPT Value
 - Seating Blows
 + Inc. Seating Blows
 i No Penetration
 - Sampler Sank
 V Vane Test
 J Borehole Jack Test
 k Permeability
 Is Point Load Index
 PE Plate Bearing Test
 CBR In-Situ CBR Test
 pd Pocket Penetrometer
 so Soakaway Test
 kp Packer Test
 * Single Test
 † Double Test

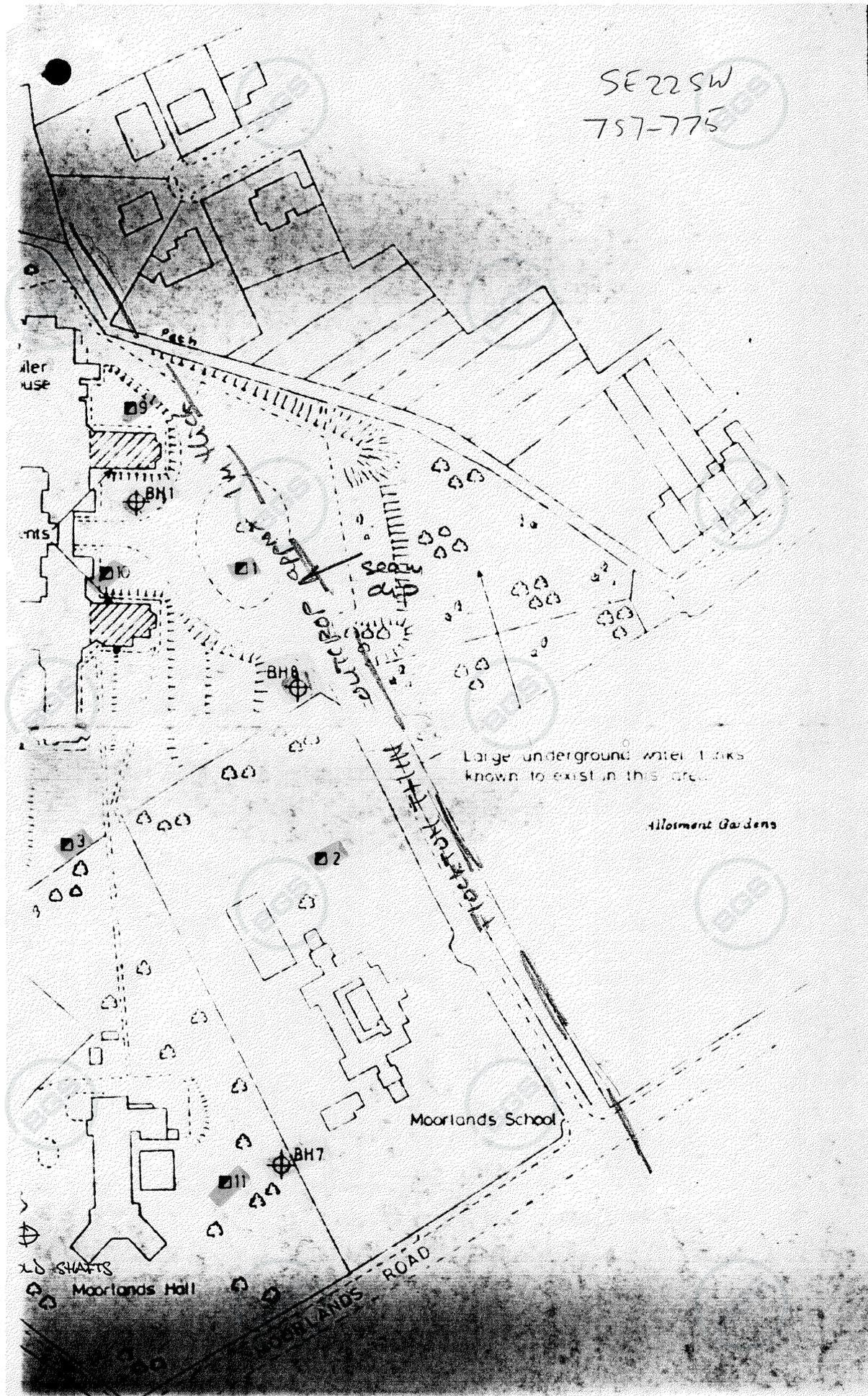
General Remarks :
 Groundwater: No groundwater encountered.
 Returns: Complete loss of returns from 7.40 to 9.30m. Poor returns below 9.30m. Drillers descriptions. Gas monitoring probe installed to 9.00m.

Scale : 10m/sheet
 Sheet No. 5 of 2.
 Depth 0 to 10 metres.
 Operator : PJT
 Appendix :
 Figure No. :



Contract : DEWSBURY HOSPITAL.						Coordinates :					
Client : Redrow Homes (Yorkshire) Limited.						Dates : 7/12/93					
Equipment and Methods : Rotary openhole drilling using 100mm rock bit and air flush.			Job Number : 18126		Orientation : Vertical						
			Borehole Number : 2		Ground Level :						
			Location : Dewsbury.								
Daily Prog.	Water Level	In-Situ tests	TCR	SCR	RQD	F	Core Run	Depth #	Strata Description	Rec. Level	Legend
								10.00	Grey SANDSTONE.		
								10.70			
								11.00	Black MUDSTONE.		
								11.40	CDAL with black mudstone bands.		
								11.70	Grey SILTSTONE.		
								12.30			
								15.00	Grey SILTSTONE with SANDSTONE.		
								15.00			
								20.00	End Of Borehole		
Key :		In-Situ Tests		DP		Pocket Penetrometer		General Remarks :			
Sample Types		SPT Value		SO		Soakaway Test		Groundwater: No groundwater encountered.			
U Undisturbed		CPT Value		KP		Packer test		Returns: Complete loss of returns from 7.40 to 9.30m. Poor returns below 9.30m. Drillers descriptions. Gas monitoring probe installed to 9.00m.			
D Disturbed		Seating Bloks		:		Single test					
B Bulk Disturbed		Inc. Seating Bloks		:		Double Test					
K Water		No Penetration									
P Piston		Sandler Sank									
J Jar		Vane Test									
T Thin Wall		Borehole Jack Test						Scale : 10m/sheet			
X No Recovery		Permeability						Sheet No. 2 Of 2			
		Is Point Load Index						Depth 10 to 20 metres.			
		PE Plate Bearing Test						Operator : PJT			
		CBR In-Situ CBR test						Appendix :			
								Figure No. :			





SE22SW
757-775

Large underground water tanks known to exist in this area.

Allotment Gardens

Moorlands School

Moorlands Hall

MOORLANDS ROAD

THORNTON ROAD

path

Water use

MS

26 SHAFTS

R O
F I
C O

R N V I E
P I E R H O U S E
T E
L O
S U

JOB TITLE

DRAWING TITLE

LOCATI

Appendix D

Yorkshire Water Asset Plan

Property Identifier



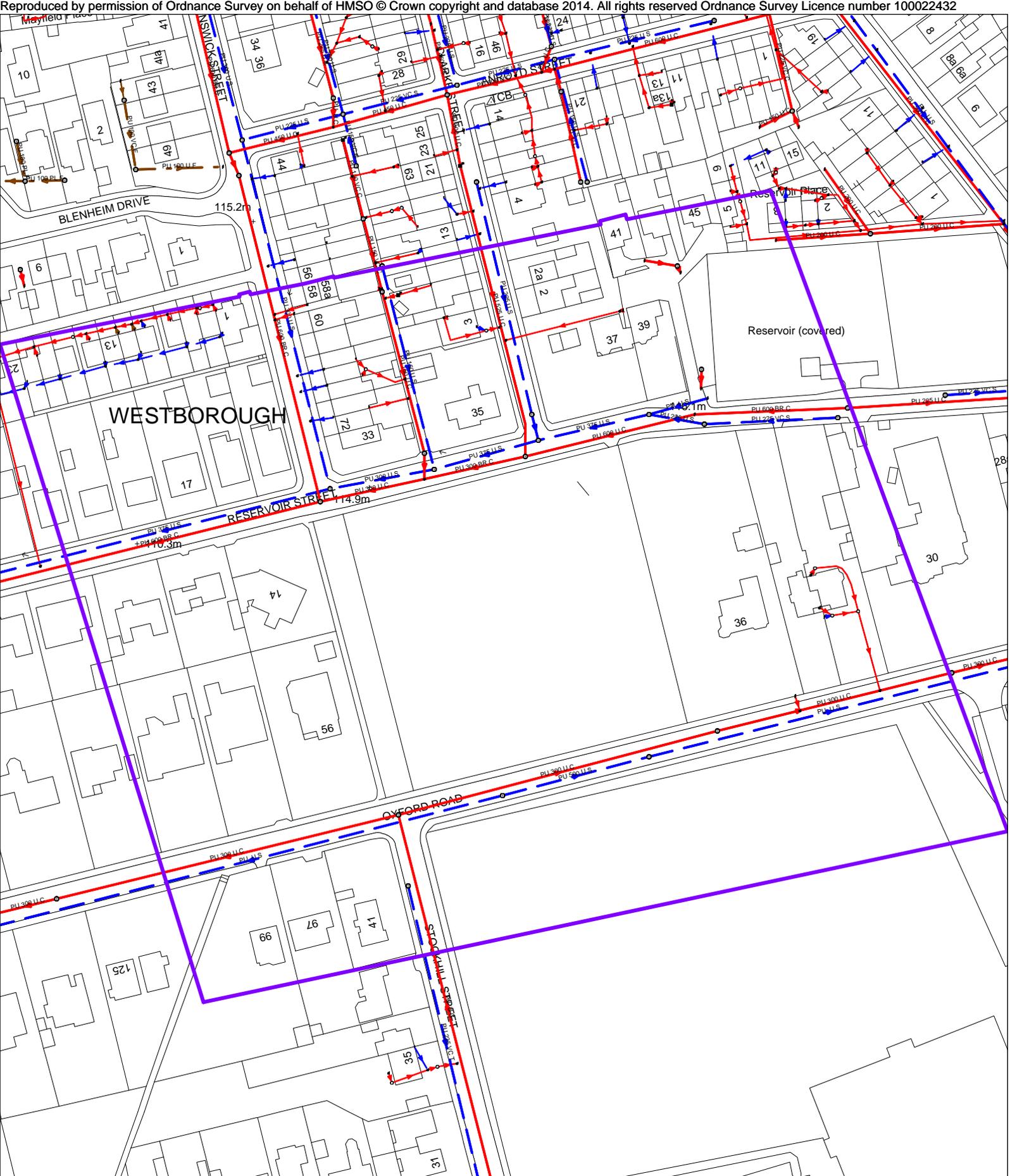
Sewer Legend

	Combined Sewer		S24 Combined Sewer
	Surface Water Sewer		S24 Surface Water Sewer
	Foul Sewer		S24 Foul Sewer
	Section 104 Sewer		Rising Main
	Overflow Sewer		Abandoned Sewer
	Syphone Sewer & Vacuum Sewer		
	Pumping Station		Public Sewer Treatment Works

Please note that the direction of flow arrows may not always appear depending on the scale of the map.

Water Legend

	Water Main 4" and below
	Water Main 4" and above
	Raw Water Main
	Private Water Main
	Fire Hydrant
	Pumping Station
	The assets in this area are the responsibility of another Water Undertaker



Public Waste Water Network 18/07/2023 11:40:43 OS Grid Coordinates: 423180 : 421979 Map Name : SE2321NW svcGISSafeMovePD

Appendix E

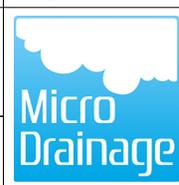
Greenfield Run-Off Rates and Volume Calculations

4 Market Square
Old Amersham
Buckinghamshire, HP7 0DQ

Fredrick Finlay CH
Greenfield Run-Off
Rate Calculations

Date 20/07/2023
File

Designed by MDS
Checked by MDS



Innovyze Source Control 2020.1.3

IH 124 Mean Annual Flood

Input

Return Period (years) 2 SAAR (mm) 730 Urban 0.000
Area (ha) 50.000 Soil 0.450 Region Number Region 3

Results l/s

QBAR Rural 230.7
QBAR Urban 230.7

Q2 years 217.7

Q1 year 198.4
Q2 years 217.7
Q5 years 288.4
Q10 years 334.5
Q20 years 378.9
Q25 years 393.6
Q30 years 405.5
Q50 years 437.0
Q100 years 479.9
Q200 years 544.5
Q250 years 565.2
Q1000 years 701.4

Flo Consult UK Ltd		Page 1
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Fredrick Finlay CH Greenfield Run-Off Volume Calculations	
Date 05/10/2023 File	Designed by MDS Checked by MDS	
Innovyze	Source Control 2020.1.3	

Greenfield Runoff Volume

FEH Data

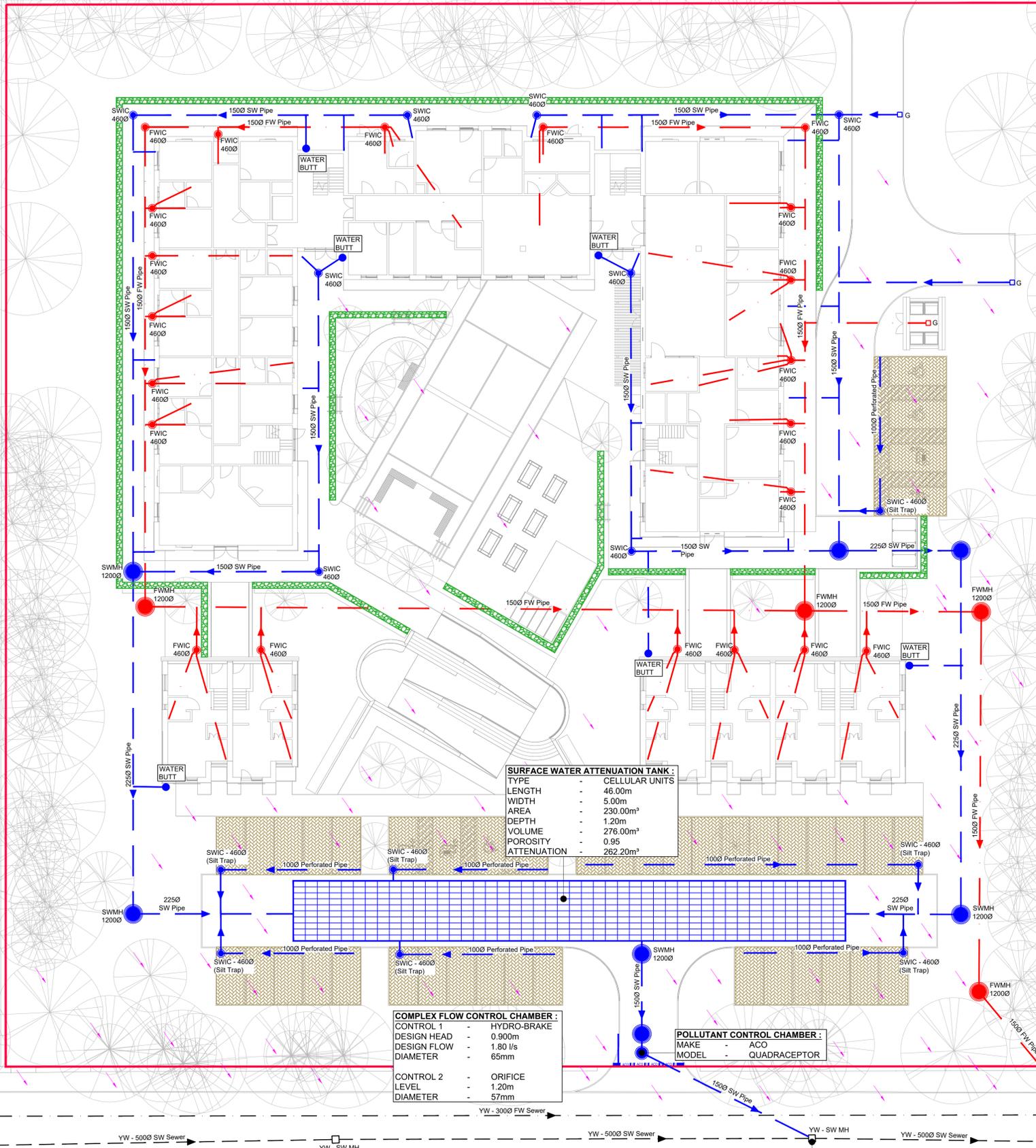
Return Period (years)	100
Storm Duration (mins)	360
FEH Rainfall Version	2013
Site Location	GB 423351 422149 SE 23351 22149
Data Type	Point
Areal Reduction Factor	1.00
Area (ha)	0.405
SAAR (mm)	715
CWI	106.935
SPR Host	47.000
URBEXT (USER)	0.0000

Results

Percentage Runoff (%)	46.40
Greenfield Runoff Volume (m ³)	116.583

Appendix F

Below Ground Drainage Layout and Details



SURFACE WATER ATTENUATION TANK :
 TYPE - CELLULAR UNITS
 LENGTH - 46.00m
 WIDTH - 5.00m
 AREA - 230.00m²
 DEPTH - 1.20m
 VOLUME - 276.00m³
 POROSITY - 0.95
 ATTENUATION - 262.20m³

COMPLEX FLOW CONTROL CHAMBER :
 CONTROL 1 - HYDRO-BRAKE
 DESIGN HEAD - 0.900m
 DESIGN FLOW - 1.80 l/s
 DIAMETER - 65mm
 CONTROL 2 - ORIFICE
 LEVEL - 1.20m
 DIAMETER - 57mm

POLLUTANT CONTROL CHAMBER :
 MAKE - ACO
 MODEL - QUADRACEPTOR

SURFACE WATER OUTFALL PIPE TO 500mm Ø YORKSHIRE WATER SURFACE WATER SEWER IN OXFORD ROAD. CONNECTION / DISCHARGE SUBJECT TO LOCAL AUTHORITY APPROVAL AND SECTION 106 AGREEMENT WITH YORKSHIRE WATER. PEAK SURFACE WATER DISCHARGE RATES :

Q1	-	1.8 l/s
Q30 + CC	-	1.9 l/s
Q100 + CC	-	3.9 l/s

NOTE :
 DISCHARGE RATES ARE EQUIVALENT TO THE SITE GREENFIELD RUN-OFF RATES.

FOUL WATER OUTFALL PIPE TO 300mm Ø YORKSHIRE WATER FOUL WATER SEWER IN OXFORD ROAD. CONNECTION / DISCHARGE SUBJECT TO SECTION 106 AGREEMENT WITH YORKSHIRE WATER. PEAK FOUL WATER DISCHARGE RATE - 4.0 l/s

DESIGN EXCEEDANCE NOTE :

IN THE UNLIKELY EVENT OF AN EXTREME STORM GREATER THAN 100-YEAR + 45% CLIMATE CHANGE, OR POOR MAINTENANCE OF THE SUDS FEATURES AND / OR PIPEWORK, POTENTIAL FLOODING OF THE DRAINAGE NETWORK COULD OCCUR.

SURFACE WATER FLOW PATHS TO FOLLOW EXISTING AND PROPOSED GROUND TOPOGRAPHY, WHERE WATER WILL FLOW TOWARDS THE SOUTH-EAST BOUNDARY AND INTO OXFORD ROAD.

FLOOD WATER WILL FLOW AWAY FROM THE PROPOSED BUILDINGS AND WILL NOT FLOW DIRECTLY TOWARDS EXISTING DWELLINGS / PROPERTIES OUTSIDE THE DEVELOPMENT BOUNDARY PRIOR TO DISCHARGE TO OXFORD ROAD. THE FLOOD WATER WITHIN THE ROAD WILL BE CONTAINED DUE TO THE ROAD HAVING A GRADIENT (WATER TO FLOW ALONG ROAD) AND UPSTAND KERBS. THEREFORE, NO INCREASE IN FLOOD RISK TO OTHER AREAS OUTSIDE THE DEVELOPMENT IN A DESIGN EXCEEDANCE EVENT.

PERMEABLE PAVING NOTE :

PERMEABLE PAVING TO BE FORMED IN THE PARKING BAYS OF THE CAR PARK TO THE SOUTH OF THE SITE.

THE PERMEABLE SURFACING WILL BE FORMED OVER A 300mm DEEP SUB-BASE CONSISTING OF 20mm NO FINES AGGREGATE, WHICH HOUSES A PERFORATED PIPE TO CONVEY THE SURFACE WATER TO THE INFILTRATION STRUCTURE.

THE PERMEABLE SURFACING SYSTEM WILL REDUCE THE SURFACE WATER RUN-OFF RATES, AND ACT AS A POLLUTANT CONTROL.

FILTER DRAIN NOTE :

FILTER DRAINS CAN BE FORMED ALONG THE EDGE OF THE COURTYARD AND FOOTPATHS AROUND THE PERIMETER OF THE MAIN BUILDING.

SURFACE WATER RUN-OFF FROM THESE AREAS WILL DISCHARGE TO THE FILTER DRAIN PRIOR TO DISCHARGE TO MAIN DRAINAGE NETWORK.

THE FILTER DRAIN WILL BE FORMED OF A 300 x 300mm DEEP TRENCH FILLED WITH 20mm NO FINES AGGREGATE AND WRAPPED IN A PERMEABLE MEMBRANE. THE TRENCH WILL HOUSE A PERFORATED PIPE WHICH WILL CONVEY THE SURFACE WATER TO THE MAIN NETWORK.

THE FILTER DRAIN SYSTEM WILL REDUCE THE SURFACE WATER RUN-OFF RATES, AND ACT AS A POLLUTANT CONTROL.

NOTES :

- IF THIS DRAWING HAS BEEN RECEIVED ELECTRONICALLY IT IS THE RECIPIENTS RESPONSIBILITY TO PRINT THE DOCUMENT TO THE CORRECT SCALE.
- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE. IT IS RECOMMENDED THAT INFORMATION IS NOT SCALED OFF THIS DRAWING.
- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.
- ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.

LEGEND :

- PROPOSED SURFACE WATER DRAINAGE
- PROPOSED FOUL WATER DRAINAGE
- EXISTING SURFACE WATER SEWER
- EXISTING FOUL WATER SEWER
- FILTER DRAINS (SEE NOTES)
- PERMEABLE PAVING (SEE NOTES)
- SWALE / SHALLOW POND
- EXCEEDANCE EVENT FLOW ROUTES
- DEVELOPMENT BOUNDARY

THIS DRAWING IS TO BE USED FOR **PRELIMINARY INFORMATION ONLY** AND **MUST NOT** BE READ AS A CONSTRUCTION ISSUE. IT INDICATES DESIGN INTENT ONLY AND IS SUBJECT TO AMENDMENT DURING FINAL DESIGN DEVELOPMENT

PRELIMINARY DRAWING ISSUE

P02	UPDATED TO SUIT REVISED ARCHITECT'S SITE PLAN	MDS	10.10.23
P01	ISSUED FOR PLANNING	MDS	20.07.23
rev	amendments	by	date

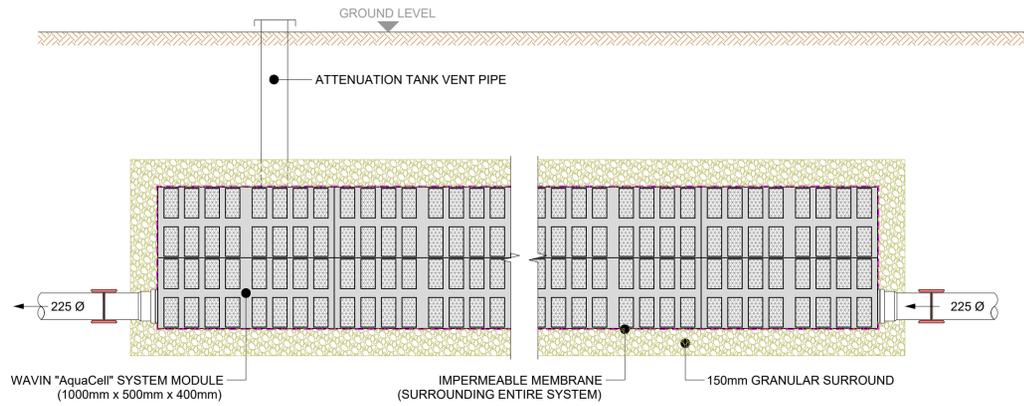


Client : **ASH MARTIN CONSTRUCTION**

Project : **FREDRICK FINLAY CARE HOME, OXFORD ROAD, DEWSBURY**

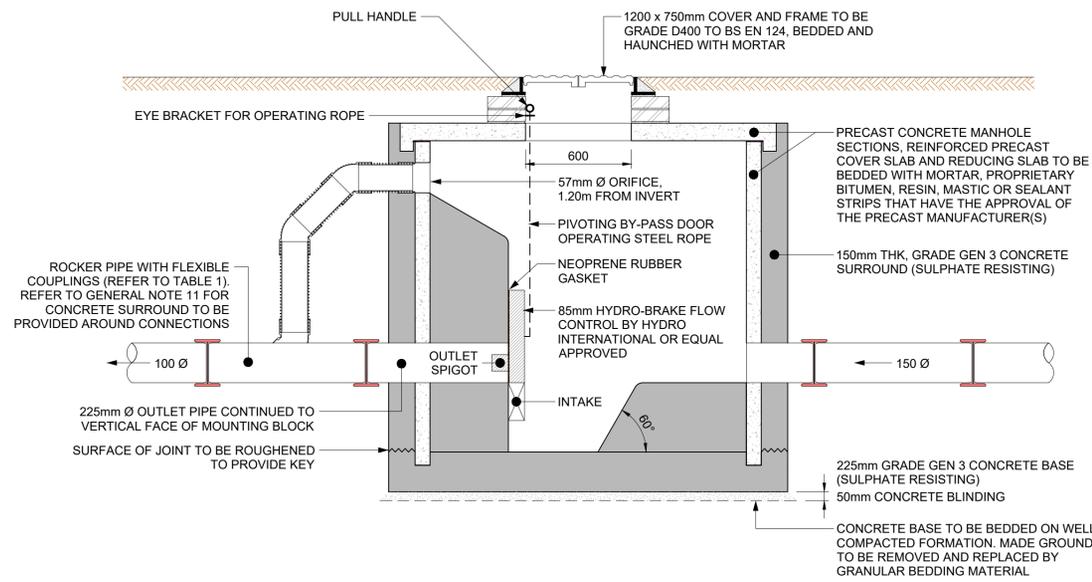
Title : **OUTLINE DRAINAGE LAYOUT**

Drawing Status :	Date Created :	Drawing Scale :
PRELIMINARY	JULY '23	1:200
Project Number Originator Vol. Level Type Role Number	Rev :	
LE-161 - CCS - 01 - 00 - DR - S - 0200	P02	
Project Leader :	Drawn By :	Initial Review :
JB	MDS	MDS

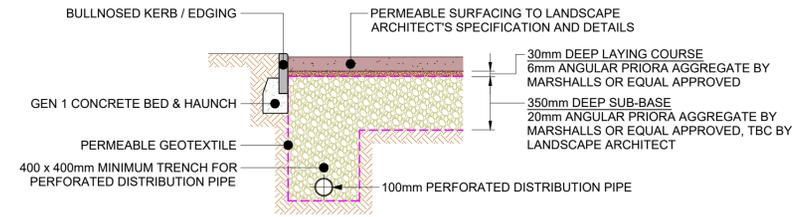


NOTE :
ATTENUATION TANK TO BE INSTALLED IN STRICT ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATION, GUIDELINES AND DETAILS

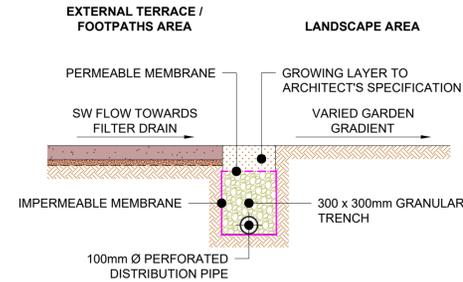
ATTENUATION TANK DETAIL



FLOW CONTROL CHAMBER DETAIL



PERMEABLE SURFACING DRAINAGE DETAIL



FILTER DRAIN DETAIL

NOTES :

1. IF THIS DRAWING HAS BEEN RECEIVED ELECTRONICALLY IT IS THE RECIPIENTS RESPONSIBILITY TO PRINT THE DOCUMENT TO THE CORRECT SCALE.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE. IT IS RECOMMENDED THAT INFORMATION IS NOT SCALED OFF THIS DRAWING.
3. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.
4. ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.

THIS DRAWING IS TO BE USED FOR PRELIMINARY INFORMATION ONLY AND **MUST NOT** BE READ AS A CONSTRUCTION ISSUE. IT INDICATES DESIGN INTENT ONLY AND IS SUBJECT TO AMENDMENT DURING FINAL DESIGN DEVELOPMENT

PRELIMINARY DRAWING ISSUE

P01	PRELIMINARY DRAWING ISSUE	MDS	10.10.23
rev	amendments	by	date



Client :
ASH MARTIN CONSTRUCTION

Project :
FREDRICK FINLAY CARE HOME, OXFORD ROAD, DEWSBURY

Title :
OUTLINE DRAINAGE DETAILS

Drawing Status :	Date Created :	Drawing Scale :
PRELIMINARY	JULY '23	N.T.S.
Project Number Originator Vol. Level Type Role Number	Rev :	
LE-161-CCS- 01 - 00 - DR - S - 0201	P01	
Project Leader :	Drawn By :	Initial Review :
JB	MDS	MDS

Appendix G

Surface Water Network / Management Calculations

Flo Consult UK Ltd		Page 1
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Fredrick Finlay CH Surface Water Management Calculations	
Date 05/10/2023 File Fedrick Finlay CH - SW M...	Designed by MDS Checked by MDS	
Innovyze	Source Control 2020.1.3	

Summary of Results for 2 year Return Period

Half Drain Time : 243 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m ³)	Status
15 min Summer	111.287	0.087	0.0	1.8	1.8	19.7	O K
30 min Summer	111.312	0.112	0.0	1.8	1.8	25.5	O K
60 min Summer	111.335	0.135	0.0	1.8	1.8	30.7	O K
120 min Summer	111.369	0.169	0.0	1.8	1.8	38.5	O K
180 min Summer	111.383	0.183	0.0	1.8	1.8	41.6	O K
240 min Summer	111.388	0.188	0.0	1.8	1.8	42.8	O K
360 min Summer	111.390	0.190	0.0	1.8	1.8	43.4	O K
480 min Summer	111.391	0.191	0.0	1.8	1.8	43.5	O K
600 min Summer	111.389	0.189	0.0	1.8	1.8	43.2	O K
720 min Summer	111.387	0.187	0.0	1.8	1.8	42.6	O K
960 min Summer	111.380	0.180	0.0	1.8	1.8	41.1	O K
1440 min Summer	111.363	0.163	0.0	1.8	1.8	37.1	O K
2160 min Summer	111.333	0.133	0.0	1.8	1.8	30.3	O K
2880 min Summer	111.305	0.105	0.0	1.8	1.8	24.0	O K
4320 min Summer	111.261	0.061	0.0	1.7	1.7	13.9	O K
5760 min Summer	111.231	0.031	0.0	1.6	1.6	7.2	O K
7200 min Summer	111.213	0.013	0.0	1.6	1.6	2.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	30.563	0.0	23.1	35
30 min Summer	19.914	0.0	30.1	47
60 min Summer	12.550	0.0	38.1	72
120 min Summer	8.471	0.0	51.3	126
180 min Summer	6.605	0.0	60.0	182
240 min Summer	5.501	0.0	66.7	222
360 min Summer	4.221	0.0	76.8	288
480 min Summer	3.488	0.0	84.6	356
600 min Summer	3.005	0.0	91.2	426
720 min Summer	2.658	0.0	96.8	496
960 min Summer	2.189	0.0	106.2	634
1440 min Summer	1.662	0.0	121.0	908
2160 min Summer	1.258	0.0	137.5	1300
2880 min Summer	1.031	0.0	150.2	1676
4320 min Summer	0.777	0.0	169.9	2388
5760 min Summer	0.637	0.0	185.8	3072
7200 min Summer	0.548	0.0	199.6	3760

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	111.203	0.003	0.0	1.5	1.5	0.6	O K
10080 min Summer	111.200	0.000	0.0	1.5	1.5	0.0	O K
15 min Winter	111.299	0.099	0.0	1.8	1.8	22.5	O K
30 min Winter	111.328	0.128	0.0	1.8	1.8	29.1	O K
60 min Winter	111.355	0.155	0.0	1.8	1.8	35.3	O K
120 min Winter	111.397	0.197	0.0	1.8	1.8	44.8	O K
180 min Winter	111.415	0.215	0.0	1.8	1.8	49.1	O K
240 min Winter	111.424	0.224	0.0	1.8	1.8	51.1	O K
360 min Winter	111.426	0.226	0.0	1.8	1.8	51.6	O K
480 min Winter	111.424	0.224	0.0	1.8	1.8	51.2	O K
600 min Winter	111.421	0.221	0.0	1.8	1.8	50.5	O K
720 min Winter	111.417	0.217	0.0	1.8	1.8	49.4	O K
960 min Winter	111.403	0.203	0.0	1.8	1.8	46.4	O K
1440 min Winter	111.372	0.172	0.0	1.8	1.8	39.2	O K
2160 min Winter	111.323	0.123	0.0	1.8	1.8	28.1	O K
2880 min Winter	111.282	0.082	0.0	1.7	1.7	18.7	O K
4320 min Winter	111.225	0.025	0.0	1.6	1.6	5.7	O K
5760 min Winter	111.200	0.000	0.0	1.5	1.5	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	0.485	0.0	212.2	4416
10080 min Summer	0.439	0.0	224.0	0
15 min Winter	30.563	0.0	25.9	35
30 min Winter	19.914	0.0	33.8	48
60 min Winter	12.550	0.0	42.6	74
120 min Winter	8.471	0.0	57.5	128
180 min Winter	6.605	0.0	67.2	182
240 min Winter	5.501	0.0	74.8	238
360 min Winter	4.221	0.0	86.1	316
480 min Winter	3.488	0.0	94.7	384
600 min Winter	3.005	0.0	102.1	462
720 min Winter	2.658	0.0	108.3	540
960 min Winter	2.189	0.0	119.1	692
1440 min Winter	1.662	0.0	135.7	980
2160 min Winter	1.258	0.0	154.1	1380
2880 min Winter	1.031	0.0	168.2	1748
4320 min Winter	0.777	0.0	190.3	2428
5760 min Winter	0.637	0.0	208.1	0

Flo Consult UK Ltd		Page 3
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Fredrick Finlay CH Surface Water Management Calculations	
Date 05/10/2023	Designed by MDS	
File Fedrick Finlay CH - SW M...	Checked by MDS	
Innovyze	Source Control 2020.1.3	

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m ³)	Status
7200 min Winter	111.200	0.000	0.0	1.3	1.3	0.0	O K
8640 min Winter	111.200	0.000	0.0	1.2	1.2	0.0	O K
10080 min Winter	111.200	0.000	0.0	1.0	1.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
7200 min Winter	0.548	0.0	223.6	0
8640 min Winter	0.485	0.0	237.7	0
10080 min Winter	0.439	0.0	250.8	0

Flo Consult UK Ltd		Page 4
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Fredrick Finlay CH Surface Water Management Calculations	
Date 05/10/2023	Designed by MDS	
File Fedrick Finlay CH - SW M...	Checked by MDS	
Innovyze	Source Control 2020.1.3	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 423351 422149 SE 23351 22149
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.405

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
From:	To:	From:	To:	From:	To:
0	4 0.068	8	12 0.068	16	20 0.067
4	8 0.068	12	16 0.067	20	24 0.067

Flo Consult UK Ltd		Page 5
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Fredrick Finlay CH Surface Water Management Calculations	
Date 05/10/2023	Designed by MDS	
File Fedrick Finlay CH - SW M...	Checked by MDS	
Innovyze	Source Control 2020.1.3	

Model Details

Storage is Online Cover Level (m) 113.100

Cellular Storage Structure

Invert Level (m) 111.200 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	240.0	0.0	2.600	0.0	0.0
0.200	240.0	0.0	2.800	0.0	0.0
0.400	240.0	0.0	3.000	0.0	0.0
0.600	240.0	0.0	3.200	0.0	0.0
0.800	240.0	0.0	3.400	0.0	0.0
1.000	240.0	0.0	3.600	0.0	0.0
1.200	240.0	0.0	3.800	0.0	0.0
1.400	0.0	0.0	4.000	0.0	0.0
1.600	0.0	0.0	4.200	0.0	0.0
1.800	0.0	0.0	4.400	0.0	0.0
2.000	0.0	0.0	4.600	0.0	0.0
2.200	0.0	0.0	4.800	0.0	0.0
2.400	0.0	0.0	5.000	0.0	0.0

Complex Outflow Control

Hydro-Brake® Optimum

Unit Reference MD-SHE-0065-1800-0900-1800
 Design Head (m) 0.900
 Design Flow (l/s) 1.8
 Flush-Flo™ Calculated
 Objective Minimise upstream storage
 Application Surface
 Sump Available Yes
 Diameter (mm) 65
 Invert Level (m) 111.100
 Minimum Outlet Pipe Diameter (mm) 100
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	1.8	Kick-Flo®	0.563	1.5
Flush-Flo™	0.276	1.8	Mean Flow over Head Range	-	1.6

The hydrological calculations have been based on the Head/Discharge relationship for the

Flo Consult UK Ltd		Page 6
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Fredrick Finlay CH Surface Water Management Calculations	
Date 05/10/2023	Designed by MDS	
File Fedrick Finlay CH - SW M...	Checked by MDS	
Innovyze	Source Control 2020.1.3	

Hydro-Brake® Optimum

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)						
0.100	1.5	1.200	2.1	3.000	3.1	7.000	4.6
0.200	1.8	1.400	2.2	3.500	3.4	7.500	4.8
0.300	1.8	1.600	2.3	4.000	3.6	8.000	4.9
0.400	1.8	1.800	2.5	4.500	3.8	8.500	5.1
0.500	1.6	2.000	2.6	5.000	4.0	9.000	5.2
0.600	1.5	2.200	2.7	5.500	4.1	9.500	5.4
0.800	1.7	2.400	2.8	6.000	4.3		
1.000	1.9	2.600	2.9	6.500	4.5		

Orifice

Diameter (m) 0.035 Discharge Coefficient 0.600 Invert Level (m) 112.300

Flo Consult UK Ltd		Page 1
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Fredrick Finlay CH Surface Water Management Calculations	
Date 05/10/2023 File Fedrick Finlay CH - SW M...	Designed by MDS Checked by MDS	
Innovyze	Source Control 2020.1.3	

Summary of Results for 30 year Return Period (+40%)

Half Drain Time : 970 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m ³)	Status
15 min Summer	111.524	0.324	0.0	1.8	1.8	74.0	O K
30 min Summer	111.630	0.430	0.0	1.8	1.8	98.1	O K
60 min Summer	111.740	0.540	0.0	1.8	1.8	123.1	O K
120 min Summer	111.826	0.626	0.0	1.8	1.8	142.7	O K
180 min Summer	111.872	0.672	0.0	1.8	1.8	153.2	O K
240 min Summer	111.900	0.700	0.0	1.8	1.8	159.6	O K
360 min Summer	111.930	0.730	0.0	1.8	1.8	166.4	O K
480 min Summer	111.940	0.740	0.0	1.8	1.8	168.8	O K
600 min Summer	111.940	0.740	0.0	1.8	1.8	168.8	O K
720 min Summer	111.934	0.734	0.0	1.8	1.8	167.2	O K
960 min Summer	111.913	0.713	0.0	1.8	1.8	162.5	O K
1440 min Summer	111.881	0.681	0.0	1.8	1.8	155.4	O K
2160 min Summer	111.844	0.644	0.0	1.8	1.8	146.9	O K
2880 min Summer	111.809	0.609	0.0	1.8	1.8	138.8	O K
4320 min Summer	111.739	0.539	0.0	1.8	1.8	122.8	O K
5760 min Summer	111.665	0.465	0.0	1.8	1.8	106.0	O K
7200 min Summer	111.585	0.385	0.0	1.8	1.8	87.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	102.492	0.0	77.7	38
30 min Summer	67.968	0.0	103.1	52
60 min Summer	43.092	0.0	130.8	80
120 min Summer	25.728	0.0	156.1	138
180 min Summer	18.942	0.0	172.4	196
240 min Summer	15.222	0.0	184.9	254
360 min Summer	11.171	0.0	203.4	370
480 min Summer	8.963	0.0	217.7	488
600 min Summer	7.556	0.0	229.3	604
720 min Summer	6.572	0.0	239.4	722
960 min Summer	5.276	0.0	256.4	848
1440 min Summer	3.880	0.0	278.1	1104
2160 min Summer	2.859	0.0	312.6	1512
2880 min Summer	2.307	0.0	336.5	1932
4320 min Summer	1.712	0.0	374.3	2772
5760 min Summer	1.393	0.0	406.1	3592
7200 min Summer	1.193	0.0	435.0	4328

Flo Consult UK Ltd		Page 2
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Fredrick Finlay CH Surface Water Management Calculations	
Date 05/10/2023	Designed by MDS	
File Fedrick Finlay CH - SW M...	Checked by MDS	
Innovyze	Source Control 2020.1.3	

Summary of Results for 30 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	111.522	0.322	0.0	1.8	1.8	73.5	O K
10080 min Summer	111.470	0.270	0.0	1.8	1.8	61.5	O K
15 min Winter	111.566	0.366	0.0	1.8	1.8	83.4	O K
30 min Winter	111.685	0.485	0.0	1.8	1.8	110.6	O K
60 min Winter	111.809	0.609	0.0	1.8	1.8	138.9	O K
120 min Winter	111.909	0.709	0.0	1.8	1.8	161.6	O K
180 min Winter	111.964	0.764	0.0	1.8	1.8	174.1	O K
240 min Winter	111.999	0.799	0.0	1.8	1.8	182.1	O K
360 min Winter	112.039	0.839	0.0	1.8	1.8	191.2	O K
480 min Winter	112.057	0.857	0.0	1.8	1.8	195.3	O K
600 min Winter	112.063	0.863	0.0	1.9	1.9	196.7	O K
720 min Winter	112.062	0.862	0.0	1.9	1.9	196.4	O K
960 min Winter	112.046	0.846	0.0	1.8	1.8	192.9	O K
1440 min Winter	112.000	0.800	0.0	1.8	1.8	182.4	O K
2160 min Winter	111.947	0.747	0.0	1.8	1.8	170.2	O K
2880 min Winter	111.892	0.692	0.0	1.8	1.8	157.8	O K
4320 min Winter	111.780	0.580	0.0	1.8	1.8	132.2	O K
5760 min Winter	111.656	0.456	0.0	1.8	1.8	103.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.055	0.0	461.5	5024
10080 min Summer	0.953	0.0	486.6	5752
15 min Winter	102.492	0.0	87.1	38
30 min Winter	67.968	0.0	115.5	52
60 min Winter	43.092	0.0	146.5	80
120 min Winter	25.728	0.0	175.0	136
180 min Winter	18.942	0.0	193.2	194
240 min Winter	15.222	0.0	207.0	250
360 min Winter	11.171	0.0	227.9	364
480 min Winter	8.963	0.0	243.8	478
600 min Winter	7.556	0.0	257.0	592
720 min Winter	6.572	0.0	268.2	702
960 min Winter	5.276	0.0	287.1	916
1440 min Winter	3.880	0.0	284.0	1156
2160 min Winter	2.859	0.0	350.0	1620
2880 min Winter	2.307	0.0	376.6	2088
4320 min Winter	1.712	0.0	419.4	2996
5760 min Winter	1.393	0.0	455.0	3880

Flo Consult UK Ltd		Page 3
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Fredrick Finlay CH Surface Water Management Calculations	
Date 05/10/2023	Designed by MDS	
File Fedrick Finlay CH - SW M...	Checked by MDS	
Innovyze	Source Control 2020.1.3	

Summary of Results for 30 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m ³)	Status
7200 min Winter	111.528	0.328	0.0	1.8	1.8	74.9	O K
8640 min Winter	111.436	0.236	0.0	1.8	1.8	53.9	O K
10080 min Winter	111.366	0.166	0.0	1.8	1.8	37.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
7200 min Winter	1.193	0.0	487.0	4544
8640 min Winter	1.055	0.0	516.9	5208
10080 min Winter	0.953	0.0	544.7	5864

Flo Consult UK Ltd		Page 4
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Fredrick Finlay CH Surface Water Management Calculations	
Date 05/10/2023	Designed by MDS	
File Fedrick Finlay CH - SW M...	Checked by MDS	
Innovyze	Source Control 2020.1.3	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 423351 422149 SE 23351 22149
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.405

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
From:	To:	From:	To:	From:	To:
0	4 0.068	8	12 0.068	16	20 0.067
4	8 0.068	12	16 0.067	20	24 0.067

Flo Consult UK Ltd		Page 5
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Fredrick Finlay CH Surface Water Management Calculations	
Date 05/10/2023	Designed by MDS	
File Fedrick Finlay CH - SW M...	Checked by MDS	
Innovyze	Source Control 2020.1.3	

Model Details

Storage is Online Cover Level (m) 113.100

Cellular Storage Structure

Invert Level (m) 111.200 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	240.0	0.0	2.600	0.0	0.0
0.200	240.0	0.0	2.800	0.0	0.0
0.400	240.0	0.0	3.000	0.0	0.0
0.600	240.0	0.0	3.200	0.0	0.0
0.800	240.0	0.0	3.400	0.0	0.0
1.000	240.0	0.0	3.600	0.0	0.0
1.200	240.0	0.0	3.800	0.0	0.0
1.400	0.0	0.0	4.000	0.0	0.0
1.600	0.0	0.0	4.200	0.0	0.0
1.800	0.0	0.0	4.400	0.0	0.0
2.000	0.0	0.0	4.600	0.0	0.0
2.200	0.0	0.0	4.800	0.0	0.0
2.400	0.0	0.0	5.000	0.0	0.0

Complex Outflow Control

Hydro-Brake® Optimum

Unit Reference MD-SHE-0065-1800-0900-1800
 Design Head (m) 0.900
 Design Flow (l/s) 1.8
 Flush-Flo™ Calculated
 Objective Minimise upstream storage
 Application Surface
 Sump Available Yes
 Diameter (mm) 65
 Invert Level (m) 111.100
 Minimum Outlet Pipe Diameter (mm) 100
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	1.8	Kick-Flo®	0.563	1.5
Flush-Flo™	0.276	1.8	Mean Flow over Head Range	-	1.6

The hydrological calculations have been based on the Head/Discharge relationship for the

Flo Consult UK Ltd		Page 6
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Fredrick Finlay CH Surface Water Management Calculations	
Date 05/10/2023	Designed by MDS	
File Fedrick Finlay CH - SW M...	Checked by MDS	
Innovyze	Source Control 2020.1.3	

Hydro-Brake® Optimum

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)						
0.100	1.5	1.200	2.1	3.000	3.1	7.000	4.6
0.200	1.8	1.400	2.2	3.500	3.4	7.500	4.8
0.300	1.8	1.600	2.3	4.000	3.6	8.000	4.9
0.400	1.8	1.800	2.5	4.500	3.8	8.500	5.1
0.500	1.6	2.000	2.6	5.000	4.0	9.000	5.2
0.600	1.5	2.200	2.7	5.500	4.1	9.500	5.4
0.800	1.7	2.400	2.8	6.000	4.3		
1.000	1.9	2.600	2.9	6.500	4.5		

Orifice

Diameter (m) 0.035 Discharge Coefficient 0.600 Invert Level (m) 112.300

Flo Consult UK Ltd		Page 1
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Fredrick Finlay CH Surface Water Management Calculations	
Date 05/10/2023 File Fedrick Finlay CH - SW M...	Designed by MDS Checked by MDS	
Innovyze	Source Control 2020.1.3	

Summary of Results for 100 year Return Period (+45%)

Half Drain Time : 1027 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m ³)	Status
15 min Summer	111.650	0.450	0.0	1.8	1.8	102.6	O K
30 min Summer	111.802	0.602	0.0	1.8	1.8	137.3	O K
60 min Summer	111.962	0.762	0.0	1.8	1.8	173.7	O K
120 min Summer	112.075	0.875	0.0	1.9	1.9	199.5	O K
180 min Summer	112.138	0.938	0.0	1.9	1.9	213.8	O K
240 min Summer	112.178	0.978	0.0	2.0	2.0	223.0	O K
360 min Summer	112.223	1.023	0.0	2.0	2.0	233.2	O K
480 min Summer	112.242	1.042	0.0	2.0	2.0	237.6	O K
600 min Summer	112.248	1.048	0.0	2.0	2.0	238.9	O K
720 min Summer	112.245	1.045	0.0	2.0	2.0	238.2	O K
960 min Summer	112.223	1.023	0.0	2.0	2.0	233.2	O K
1440 min Summer	112.174	0.974	0.0	1.9	1.9	222.2	O K
2160 min Summer	112.122	0.922	0.0	1.9	1.9	210.3	O K
2880 min Summer	112.081	0.881	0.0	1.9	1.9	201.0	O K
4320 min Summer	112.009	0.809	0.0	1.8	1.8	184.5	O K
5760 min Summer	111.945	0.745	0.0	1.8	1.8	169.9	O K
7200 min Summer	111.887	0.687	0.0	1.8	1.8	156.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	140.081	0.0	106.3	38
30 min Summer	93.769	0.0	142.3	53
60 min Summer	59.897	0.0	181.8	82
120 min Summer	35.217	0.0	213.8	140
180 min Summer	25.750	0.0	234.6	198
240 min Summer	20.593	0.0	250.1	256
360 min Summer	14.991	0.0	273.1	372
480 min Summer	11.954	0.0	290.5	490
600 min Summer	10.027	0.0	300.3	606
720 min Summer	8.684	0.0	300.9	724
960 min Summer	6.922	0.0	300.0	932
1440 min Summer	5.042	0.0	295.2	1160
2160 min Summer	3.682	0.0	402.5	1556
2880 min Summer	2.955	0.0	431.0	1972
4320 min Summer	2.181	0.0	477.0	2812
5760 min Summer	1.769	0.0	515.5	3640
7200 min Summer	1.512	0.0	551.1	4472

Flo Consult UK Ltd		Page 2
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Fredrick Finlay CH Surface Water Management Calculations	
Date 05/10/2023	Designed by MDS	
File Fedrick Finlay CH - SW M...	Checked by MDS	
Innovyze	Source Control 2020.1.3	

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	111.834	0.634	0.0	1.8	1.8	144.4	O K
10080 min Summer	111.783	0.583	0.0	1.8	1.8	132.9	O K
15 min Winter	111.706	0.506	0.0	1.8	1.8	115.4	O K
30 min Winter	111.877	0.677	0.0	1.8	1.8	154.4	O K
60 min Winter	112.058	0.858	0.0	1.9	1.9	195.6	O K
120 min Winter	112.188	0.988	0.0	2.0	2.0	225.3	O K
180 min Winter	112.262	1.062	0.0	2.0	2.0	242.2	O K
240 min Winter	112.311	1.111	0.0	2.1	2.1	253.3	O K
360 min Winter	112.363	1.163	0.0	2.6	2.6	265.1	O K
480 min Winter	112.384	1.184	0.0	2.8	2.8	269.9	O K
600 min Winter	112.390	1.190	0.0	2.8	2.8	271.3	O K
720 min Winter	112.388	1.188	0.0	2.8	2.8	270.9	O K
960 min Winter	112.372	1.172	0.0	2.7	2.7	267.1	O K
1440 min Winter	112.339	1.139	0.0	2.4	2.4	259.7	O K
2160 min Winter	112.277	1.077	0.0	2.0	2.0	245.6	O K
2880 min Winter	112.218	1.018	0.0	2.0	2.0	232.1	O K
4320 min Winter	112.105	0.905	0.0	1.9	1.9	206.4	O K
5760 min Winter	112.001	0.801	0.0	1.8	1.8	182.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.334	0.0	583.4	5280
10080 min Summer	1.204	0.0	614.2	6064
15 min Winter	140.081	0.0	119.0	38
30 min Winter	93.769	0.0	143.6	52
60 min Winter	59.897	0.0	203.5	80
120 min Winter	35.217	0.0	239.4	138
180 min Winter	25.750	0.0	262.7	194
240 min Winter	20.593	0.0	280.2	252
360 min Winter	14.991	0.0	305.8	364
480 min Winter	11.954	0.0	310.9	476
600 min Winter	10.027	0.0	313.6	588
720 min Winter	8.684	0.0	314.9	696
960 min Winter	6.922	0.0	315.1	900
1440 min Winter	5.042	0.0	310.4	1146
2160 min Winter	3.682	0.0	450.9	1656
2880 min Winter	2.955	0.0	482.6	2120
4320 min Winter	2.181	0.0	534.3	3036
5760 min Winter	1.769	0.0	577.2	3928

Flo Consult UK Ltd		Page 3
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Fredrick Finlay CH Surface Water Management Calculations	
Date 05/10/2023	Designed by MDS	
File Fedrick Finlay CH - SW M...	Checked by MDS	
Innovyze	Source Control 2020.1.3	

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m ³)	Status
7200 min Winter	111.906	0.706	0.0	1.8	1.8	161.0	O K
8640 min Winter	111.817	0.617	0.0	1.8	1.8	140.6	O K
10080 min Winter	111.726	0.526	0.0	1.8	1.8	119.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
7200 min Winter	1.512	0.0	617.2	4824
8640 min Winter	1.334	0.0	653.5	5704
10080 min Winter	1.204	0.0	687.7	6560

Flo Consult UK Ltd		Page 4
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Fredrick Finlay CH Surface Water Management Calculations	
Date 05/10/2023	Designed by MDS	
File Fedrick Finlay CH - SW M...	Checked by MDS	
Innovyze	Source Control 2020.1.3	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 423351 422149 SE 23351 22149
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+45

Time Area Diagram

Total Area (ha) 0.405

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
From:	To:	From:	To:	From:	To:
0	4 0.068	8	12 0.068	16	20 0.067
4	8 0.068	12	16 0.067	20	24 0.067

Flo Consult UK Ltd		Page 5
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Fredrick Finlay CH Surface Water Management Calculations	
Date 05/10/2023	Designed by MDS	
File Fedrick Finlay CH - SW M...	Checked by MDS	
Innovyze	Source Control 2020.1.3	

Model Details

Storage is Online Cover Level (m) 113.100

Cellular Storage Structure

Invert Level (m) 111.200 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	240.0	0.0	2.600	0.0	0.0
0.200	240.0	0.0	2.800	0.0	0.0
0.400	240.0	0.0	3.000	0.0	0.0
0.600	240.0	0.0	3.200	0.0	0.0
0.800	240.0	0.0	3.400	0.0	0.0
1.000	240.0	0.0	3.600	0.0	0.0
1.200	240.0	0.0	3.800	0.0	0.0
1.400	0.0	0.0	4.000	0.0	0.0
1.600	0.0	0.0	4.200	0.0	0.0
1.800	0.0	0.0	4.400	0.0	0.0
2.000	0.0	0.0	4.600	0.0	0.0
2.200	0.0	0.0	4.800	0.0	0.0
2.400	0.0	0.0	5.000	0.0	0.0

Complex Outflow Control

Hydro-Brake® Optimum

Unit Reference MD-SHE-0065-1800-0900-1800
 Design Head (m) 0.900
 Design Flow (l/s) 1.8
 Flush-Flo™ Calculated
 Objective Minimise upstream storage
 Application Surface
 Sump Available Yes
 Diameter (mm) 65
 Invert Level (m) 111.100
 Minimum Outlet Pipe Diameter (mm) 100
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	1.8	Kick-Flo®	0.563	1.5
Flush-Flo™	0.276	1.8	Mean Flow over Head Range	-	1.6

The hydrological calculations have been based on the Head/Discharge relationship for the

Flo Consult UK Ltd		Page 6
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Fredrick Finlay CH Surface Water Management Calculations	
Date 05/10/2023	Designed by MDS	
File Fedrick Finlay CH - SW M...	Checked by MDS	
Innovyze	Source Control 2020.1.3	

Hydro-Brake® Optimum

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)						
0.100	1.5	1.200	2.1	3.000	3.1	7.000	4.6
0.200	1.8	1.400	2.2	3.500	3.4	7.500	4.8
0.300	1.8	1.600	2.3	4.000	3.6	8.000	4.9
0.400	1.8	1.800	2.5	4.500	3.8	8.500	5.1
0.500	1.6	2.000	2.6	5.000	4.0	9.000	5.2
0.600	1.5	2.200	2.7	5.500	4.1	9.500	5.4
0.800	1.7	2.400	2.8	6.000	4.3		
1.000	1.9	2.600	2.9	6.500	4.5		

Orifice

Diameter (m) 0.035 Discharge Coefficient 0.600 Invert Level (m) 112.300

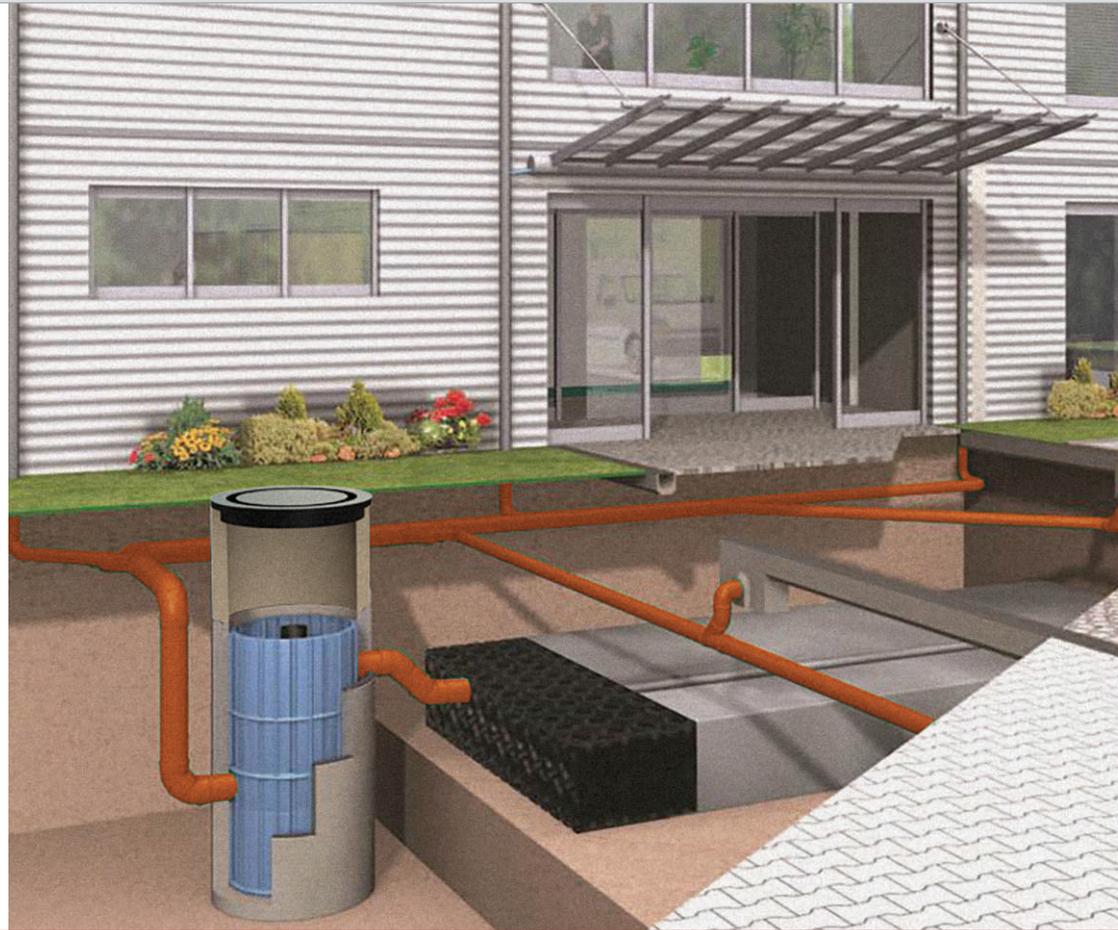
Appendix H

Pollutant Control Chamber

Uniclass L7315 + L2123	EPIC J3413
CI/SfB (52.5)	In6

ACO Water Management: Civils + Infrastructure

ACO QuadraCeptor



ACO QuadraCeptor

Four Stage Surface Water Treatment Unit



Introduction to ACO QuadraCeptor

ACO QuadraCeptor is a specialist rainwater and surface water runoff filtration system for the removal of sediment and harmful pollutants.

Surface Water Management

ACO QuadraCeptor is an efficient and reliable system for the treatment of surface water run-off from roofs, car parks and roads, even in heavily trafficked areas, before discharge in to ground (infiltration) or to a surface water feature.

The system has been designed to remove, in a four stage process, heavy particles, silt and nutrients and dissolved materials, such as heavy metals, from the surface water as part of an integrated Sustainable Drainage Solution. ACO QuadraCeptor will improve the water quality ensuring pollutants are not infiltrated into the soil.

Where infiltration is not feasible, the surface water discharged from site needs to be treated to an acceptable level.

Where this is to a watercourse, the Environment Agency (in England), the Scottish Environmental Protection Agency or Natural Resources Wales in line with legislation and guidelines such as the Water Framework Directive, will determine the levels of pollutants that can be discharged from site based on a number of factors such as the sensitivity of the receiving water, the dilution, etc.

Using the ACO QuadraCeptor at some point in the SuDS treatment train before discharge ensures clean surface water run-off is discharged from site meeting discharge consent limits on pollutants.

ACO's Water Management solutions team's technical expertise and knowledge of current best practice is your assurance of an affordable, long term sustainable solution.

Source control

Source Control: Changes in the Planning process for new developments from April 2015 will require all development, except the most minor, to have a SuDS solution for managing surface water runoff on-site. The first objective of any SuDS scheme is to manage surface water runoff at source and, where feasible, not to allow surface water runoff to discharge from the site.



What is ACO QuadraCeptor?

The ACO QuadraCeptor uses an upflow filtration process, resulting in minimal head loss between the inlet and the outlet. The rainwater is treated within the unit by the following 4 processes: sedimentation, filtration, adsorption and precipitation. The cleaned water is of an outstanding water quality.

The initial treatment steps take place in the hydrodynamic separator stage, where sedimentation of solid particles occurs within a radial flow regime.

To prevent remobilisation, settled material passes through a funnel trap into the silt chamber at the base of the unit.

Secondary treatment of raw water occurs via a suite of filters located above the separator unit. These filtration units cover the entire diameter of the unit's housing. As water flows upwards through the removable filter elements the filtration media is kept saturated. Such saturation maximises filter efficiency by minimising the rate at which filter units clog.

The filter elements can be cleaned when required and are easy to exchange when the media is exhausted.

ACO QuadraCeptor is supplied in a plastic housing and is safe and easy to fit on site. It is designed for installation within load bearing shafts and can be installed in standard concrete or plastic chambers.

Why choose ACO QuadraCeptor

An integrated approach to surface water quantity and quality

By using ACO QuadraCeptor in conjunction with attenuation and flow control devices from ACO's water management solutions, surface water run-off can be discharged from site at an agreed rate, at a permitted quality.

Low maintenance

There are no moving parts in the ACO QuadraCeptor, meaning the only maintenance required is occasional emptying of the silt chamber (an ACO silt level alarm can be fitted) and cleaning or replacing of the filters when required.

Easy to install

The ACO QuadraCeptor is supplied as a standalone unit, easily installed in a load bearing shaft, either standard concrete or plastic chambers.

How it works

Step 1

Surface water run-off from the catchment area drains into the lower section of the QuadraCeptor shaft. A deflector plate initiates radial flow.

Step 2

Sedimentation of particles, especially the larger and denser fractions, takes place in the hydrodynamic separator due to turbulent secondary flows within the radial flow regime.

Step 3

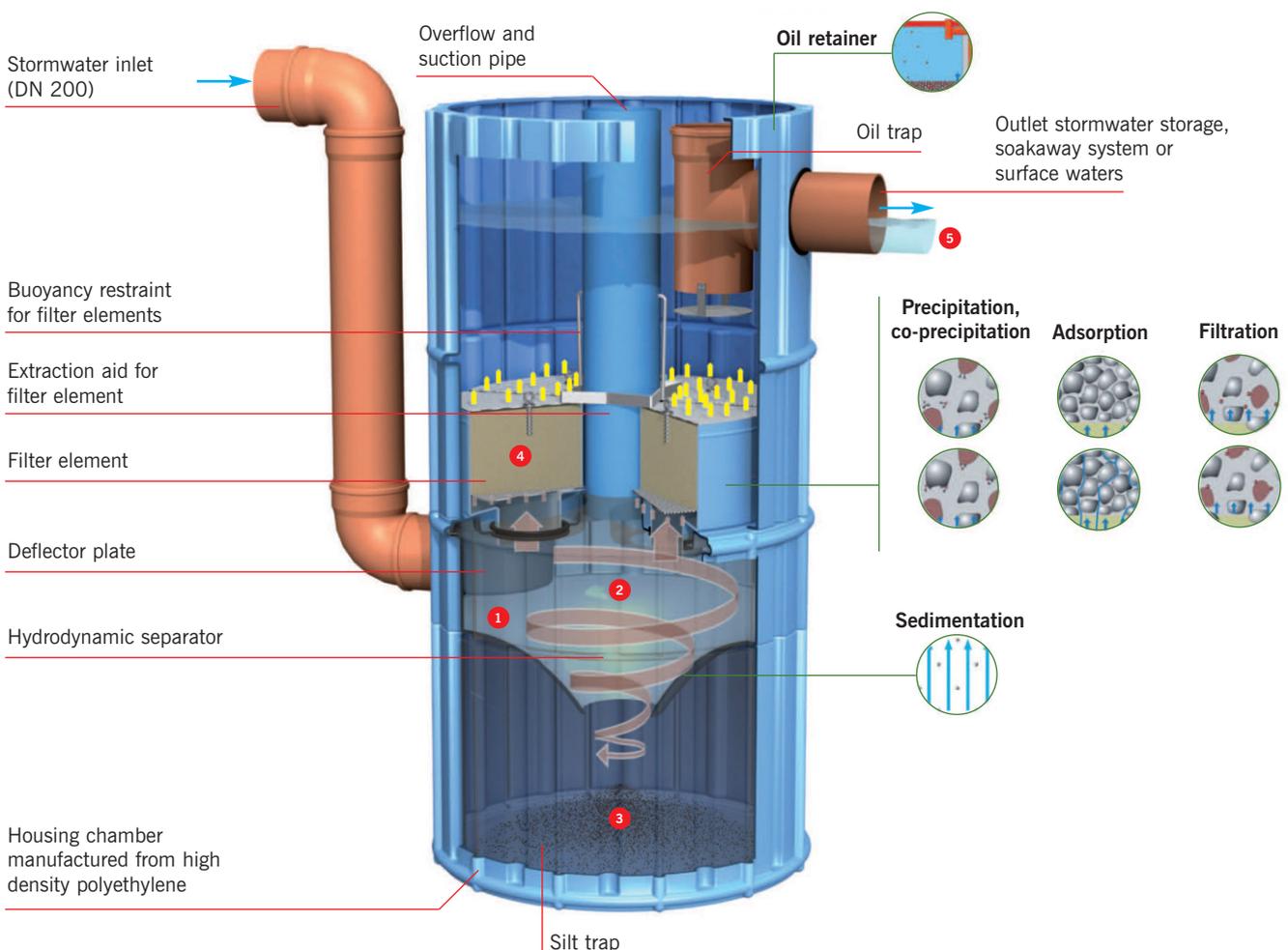
The settleable solids are retained in the silt trap chamber. This chamber should be emptied periodically, via the central by-pass tube.

Step 4

Four filter elements are located within the filter shaft. As water flows upwards fine particles are filtered out and dissolved pollutants are precipitated and adsorbed. Filter units can be backwashed simply and, if completely clogged or exhausted, can easily be replaced.

Step 5

Clean water above the filter elements passes to discharge to a soakaway or watercourse. Normal concentrations of dissolved oils are retained within the filter elements but any free floating oil that does pass through the filters is retained in an integrated oil trap.



ACO QuadraCeptor Range

The ACO QuadraCeptor is available with various filter types, depending on the usage of the connected area. The three options are:

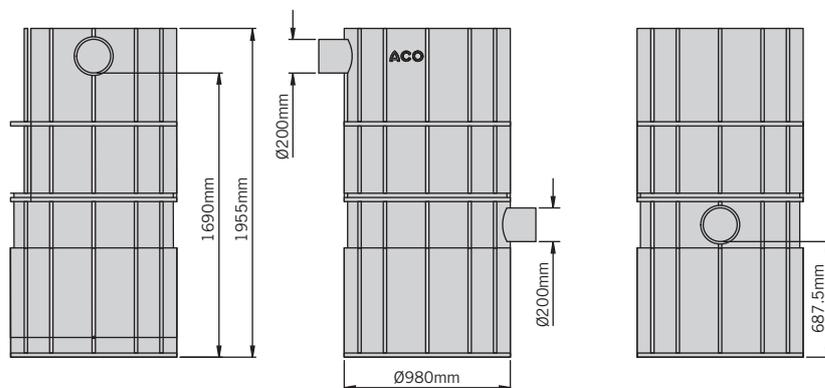
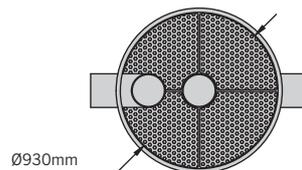
R1000 (Roof)	<p>Application: Roof areas that do not have a significant proportion of uncoated metals*</p> <p>Material: Filter Substrate: Roof</p> <p>Weight of filter element: 34kg</p> <p>Total weight of ACO QuadraCeptor unit including polyethylene housing: 220kg</p>
T750 (Traffic)	<p>Application: Trafficked areas with normal levels of pollutants, such as staff car parks and side streets.</p> <p>Material: Filter Substrate: Traffic</p> <p>Weight of filter element: 34kg</p> <p>Total weight of ACO QuadraCeptor unit including polyethylene housing: 220kg</p>
HT 500 (Heavy Traffic)	<p>Application: Heavily traffic areas, such as main highways and supermarket car parks with high vehicle turnover. This option has DIBt approval.</p> <p>Material: Filter Substrate: Heavy Traffic</p> <p>Weight of filter element: 54kg</p> <p>Total weight of ACO QuadraCeptor unit including polyethylene housing: 300kg</p>

*QuadraCeptor solutions are available for removal of high levels of copper or zinc: please contact technical@aco.co.uk or 01462 816666.

ACO QuadraCeptor

Product code	Description	Nature of the surface to be drained	Size of the surface to be drained (m ²)	Replacement filter element (set of 4)
26650	R1000 (Roof)	Roofs without a significant proportion (<5%) of uncoated metals	1000	26654
26651	T750 (Traffic)	Trafficked areas with normal levels of pollutants, such as staff car parks and side streets	750	26654
26652	HT500 (Heavy traffic)	Heavily traffic areas, such as main highways and supermarket car parks with high vehicle turnover	500	26555

Dimensions



Water quality performance

Pollution Mitigation Indices		
Total Suspended Solids	Metals	Hydrocarbons
0.8	0.8	0.8

Parameter	Unit	Typical values from surface run off					Standards		ACO QuadraCeptor output ^{*3}
		Roofs			Traffic		Drinking Water ^{*1}	Infiltration ^{*2}	
		Non metal	Copper	Zinc	Low vehicle turnover ^{*4}	High vehicle turnover ^{*5}			

Physico-chemical parameters

Conductivity	uS/cm	25 to 270	25 to 270	25 to 270	50 to 2500	110 to 2500	2500	-	< 1500
pH		4.7 - 6.8	4.7 - 6.8	4.7 - 6.8	6.4 to 8.0	6.4 to 8.0	6.5 - 9.5	-	7.0 – 9.5

Nutrients

Phosphorous, P	mg/L	0.06 to 0.5	0.06 to 0.5	0.06 to 0.5	0.09 to 0.3	0.23 to 0.35	no limit set		0.2
Ammonia/ammonium, NH4	mg/L	0.1 to 6.0	0.1 to 6.0	0.1 to 6.0	0 to 1.0	0.5 to 2.3	0.5	-	0.3
Nitrates, NO3	mg/L	0.1 to 5.0	0.1 to 5.0	0.1 to 5.0	0 to 16	0 to 16	50	-	*6

Heavy metals

Cadmium, Cd	µg/L	0.2 to 2.5	0.2 to 1.0	0.5 to 2	0.2 to 1.7	0.3 to 13	5	5	<1.0
Zinc, Zn	mg/L	24 to 4900	24 to 900	1700 - 44000	15 to 1500	120 to 2000	no limit set	500	<500 ^{*7}
Copper, Cu	mg/L	0.6 to 3.5	2000 to 8500	11 to 900	21 to 140	97 to 100	2	50	< 50 ^{*7}
Lead, Pb	µg/L	2 to 500	2 to 500	4 to 300	70 to 170	11 to 525	10	25	<25
Nickel, Ni	µg/L	2 to 7	2 to 7	2 to 7	4 to 70	4 to 70	20	50	<20
Chromium, Cr	µg/L	2 to 6	2 to 6	2 to 6	6 to 50	6 to 50	50	50	<50

Organic substances

Polycyclic aromatic hydrocarbons, PAH	µg/L	0.4 to 0.6	0.4 to 0.6	2 to 7	0.2 to 17	0.2 to 17	0.1	0.2	<0.2
Total petroleum hydrocarbons, TPH	µg/L	0.1 to 3.0	0.1 to 3.0	2 to 6	0.1 to 6.5	0.1 to 6.5	-	0.2	<0.2

Quadraceptor Model	R1000 (Roof)	Contact ACO ^{*8}	T750 (Traffic)	HT500 (Heavy Traffic)
--------------------	--------------	---------------------------	----------------	-----------------------

^{*1} Water Supply (Water Quality) Regulations 2000. Maximum values shown

^{*2} Control values for infiltration of surface water according to the German Federal Soil Protection Act (1999) and used as the basis for DIBt approval. Maximum values shown.

^{*3} Output values based on average annual loads.

^{*4} e.g. residential streets, office car parks.

^{*5} e.g. highways, supermarket car parks, distribution yards.

^{*6} Nitrate levels are not significantly reduced

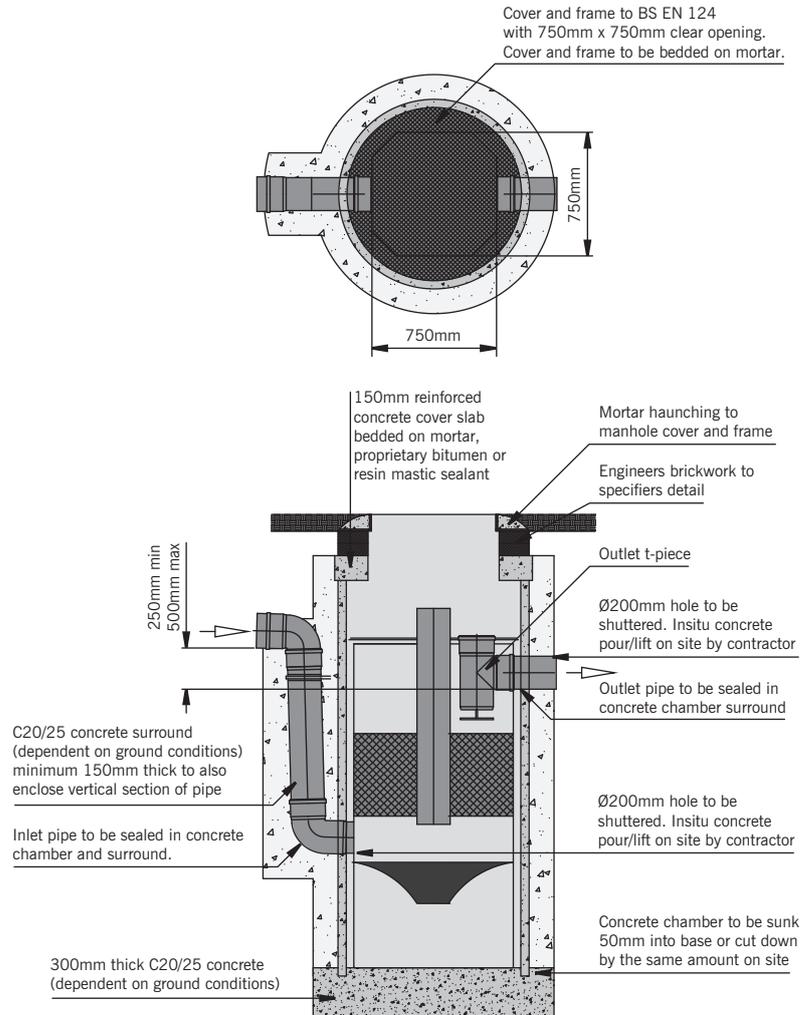
^{*7} Values shown are not applicable to copper or zinc roofs where a second treatment stage is required

^{*8} QuadraCeptor solutions are available for removal of high levels of copper or zinc: please contact technical@aco.co.uk or 01462 816666.

Installation detail

Specifiers and Contractors are advised to obtain a copy of the full installation recommendations from www.aco.co.uk, or the ACO Design Services department at technical@aco.co.uk or telephone 01462 816666.

1. This outline guidance assumes that the ACO Quadraceptor unit will be installed with a concrete backfill. Engineering advice should be sought to ensure any site specific conditions are addressed.
2. Quadraceptor units should be stored on firm level ground. Do not drag, drop or roll the units.
3. Excavate a hole to receive the unit, allowing a minimum 300mm thickness of concrete below the unit and 150 mm around the sides, allowing sufficient space for concrete surround to encapsulate the vertical inlet pipework. Allow sufficient working space for the connection of all pipework. Any unstable ground should be removed and replaced. Engineering advice may be necessary. The excavation is to be kept free of water.
4. Prior to installation all filter elements should be removed or covered to prevent contamination or fouling during installation.
5. All concrete used in the installation process must be of minimum grade C20/25. Where necessary, a higher specification concrete mix may be required and engineering advice should be sought. Pour a minimum 300mm thickness of concrete onto the base of the excavation. Whilst the concrete is still wet carefully lower the Quadraceptor unit onto the concrete. Check that the unit is fully supported by the concrete, and that the unit is level, at the correct height and in the correct orientation. Allow the concrete to harden.
6. The vertical distance from the bottom of the incoming pipework to the bottom of the outlet pipework must be a minimum of 250 mm and a maximum of 500 mm (see outline installation drawing for guidance).
7. Prior to back-filling the excavation, using appropriate concrete mix, all pipework should be connected and sealed to prevent contamination of the system, and any additional shaft rings and top cover put in place.



8. After installation filter elements should be re-installed, or anti-fouling covers removed. The end cap maintenance cover and other buoyancy protective devices should be checked for correct insertion. The T-Piece on the outlet pipework should be connected from the inside of the drainage line (see outline installation drawing for guidance).
9. Prior to commissioning and operation the ACO Quadraceptor must be inspected for proper installation by a competent person.



Maintenance and servicing

To ensure the ACO Quadrceptor surface water runoff treatment system provides continuous and reliable environmental protection it needs appropriate maintenance and servicing. Where a system is correctly maintained in accordance with supplier recommendations the environmental performance will be maintained, otherwise environmental damage and increased liability are likely to be experienced. ACO service partners work closely with the relevant UK Environment Agencies and are able to offer ongoing maintenance and servicing programmes, waste disposal, inspection, testing and full installation and commissioning of water treatment systems and alarms. For further details please contact the ACO Water Management Design Services Team on 01462 816666.

Model specification clause

The water treatment system shall be an ACO Quadrceptor water treatment system, supplied by ACO Water Management. The unit shall be manufactured from High Density Polyethylene and incorporate a filtration system appropriate to the intended end use.

The ACO Quadrceptor surface water treatment system is to be designed and manufactured in conformity with German DIBt requirements and shall be installed in accordance with the manufacturer's recommendations.



NBS Specification

ACO Quadrceptor should be specified in section R12 327. Assistance in completing this clause can be found in ACO Technologies product entries in NBS Plus or a model specification can be downloaded from www.aco.co.uk. For further assistance, contact the ACO Water Management Design Services Team.

ACO Technologies plc

- ACO Water Management
Civils + Infrastructure
Urban + Landscape
- ACO Building Drainage
- ACO Sport
- ACO Wildlife

ACO Water Management: Civils + Infrastructure

A division of ACO Technologies plc
ACO Business Park,
Hitchin Road,
Shefford,
Bedfordshire
SG17 5TE

Tel: 01462 816666
Fax: 01462 815895

e-mail Enquiries: awmenquiries@aco.co.uk
e-mail Sales: customersupport@aco.co.uk
e-mail Technical: technical@aco.co.uk

website: www.aco.co.uk

The ACO Group: A strong family you can depend on.

© October 2018 ACO Technologies plc. All reasonable care has been taken in compiling the information in this document. All recommendations and suggestions on the use of ACO products are made without guarantee since the conditions of use are beyond the control of the Company. It is the customer's responsibility to ensure that each product is fit for its intended purpose, and that the actual conditions of use are suitable. This brochure and any advice is provided by ACO Technologies plc (the Company) free of charge and accordingly on terms that no liability including liability for negligence will attach to the Company or its servants or agents arising out of or in connection with or in relation to this brochure or any such advice. Any goods supplied by the Company will be supplied solely upon its standard conditions of sale, copies of which are available on request. The Company's policy of continuous product development and improvement renders specifications liable to modification. Information provided in this brochure is therefore subject to change without prior notification.



ISO 9001
FM 13502



ISO 14001
EMS 538781



OHSAS 18001
OHS 524145