Project No

23-2425

Project

Skegness CSC
United Lincolnshire Hospitals

Title

Flood Risk Assessment and Surface Water Management Report

Date

June 2023

Revision

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Author: Mark Symonds **Date**: 27th June 2023

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Appendices

1. Introduction

This flood risk assessment and surface water management report has been prepared by CCS Consulting Ltd, on behalf of United Lincolnshire Hospitals NHS Trust, for the full planning permission of a new Community Diagnostic Centre (CDC) at Wainfleet Road, Skegness, Lincolnshire, PE25 3RR (hereafter referred to as 'the Site').

This report provides a detailed overview of the proposed development and an assessment of it in relation to the flood risk and surface water run-off management, and how the proposals have been developed in relation to current planning policy and requirements, including:

- 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).

And local policies including:

- East Lindsey Local Plan Core Strategy (Adopted July 2018);
- East Lindsey Strategic Flood Risk Assessment (March 2017);
- Joint Lincolnshire Flood Risk and Water Management Strategy 2019-2050;

East Lindsey District Council, acting as the lead local flood authority (LLFA), need to be satisfied that the design and drainage principles of the proposed development will address the risk of flooding to the development site; will ensure that the drainage is maintained to prevent flooding; and in turn not to increase the risk of flooding to neighbouring land and property.

This flood risk statement and surface water management report has therefore been prepared to identify and evaluate the various possible sources of flood risk to which the proposed site might be subjected to; to identify any mitigation, protection or compensation measures deemed necessary or feasible; and to manage the surface water so it is sustainable, and does not increase the probability of flooding within, or near the site.

2. Planning Policies and Guidance

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

NPPF 2021 Paragraphs 153 to 158 provide guidance for developments to take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk.

NPPF 2021 Paragraphs 159 to 169 provide guidance for planning and flood risk, where are plans should apply a sequential, risk-based approach to the location of development taking into account current and future impacts of climate change; to ensure that flood risk is not increased elsewhere due to the development; and to incorporate sustainable drainage systems.

NPPG, Paragraph 020 Reference ID: 7-020-20220825, outlines that the objectives of this FRA are to establish whether a proposed development is likely to be affected by current or future flooding from any source; whether it will increase flood risk elsewhere; whether the measures proposed to deal with these effects and risks are appropriate; whether there is evidence for the local planning authority to apply (if necessary) the Sequential Test; and whether the development will be safe and pass the Exception Test, if applicable.

2.2. Flood and Water Management Act

The Flood and Water Management Act (FWMA) received royal assent in April 2010, aiming to create a simpler and more effective means of managing flood risk and coastal erosion. The FWMA incorporates and implements some of the recommendations from the Pitt Review (2008), following the severe flooding that affected a large area of the UK in 2007.

The FWMA also places several new duties and responsibilities on LLFAs regarding the management of local flood risk, to:

- Develop, maintain, apply, and monitor a Local Flood Risk Management Strategy.
- Approve, adopt, and maintain Sustainable Drainage Systems (SuDS) (yet to be implemented).
- Establish and maintain a flood risk Asset Register.
- incidents of flooding (where appropriate) and publish the findings in a report.
- Ensure delivery of effective and joined up management of flood risk.

3. Site Setting and Description

3.1. Site Location

The Site is in a residential / commercial area of Skegness, is approximately 500m north-west of Skegness station, and as shown in Appendix A, is bound by undeveloped land leading to Westfield Drive to the north, commercial buildings leading to Grantham Drive to the east; Old Wainfleet Road to the south, and a commercial building directly to the west.

The nearest postcode to the site is PE25 3RR, with the co-ordinates to the centre of the site being E: 555900, N: 363500.

3.2. Existing Site and Topography

As detailed on the topographical survey / existing site plan in Appendix B, the Site currently consists of a car park to the north, and an access road (from Wainfleet Drive) to the south. As the Site is already developed, it is deemed to be 'brownfield'. In terms of topography, the Site has a general fall towards the northern boundary with the high-point at the site entrance (southern boundary) being approximately 3.31m AOD and the low-point along the northern boundary being approximately 2.23m AOD.

3.3. Proposed Development

The proposed site plan is shown in Appendix C, with a full description of the Site being stated by the Architect. In brief, and in relation to this report, the proposed development is to build the CDC building to the north of the site with an access road leading to the required building infrastructure to the east, a reformed car park to the centre, existing / reformed access road to the south, and small soft-landscape areas 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 superficial deposits of Tidal Flat Deposits (clay and silt), over bedrock consisting of Wilmslow Ferriby Chalk Formation (chalk). The BGS website also shows borehole log data in an area directly adjacent to the Site (see Appendix D), which shows the ground to predominantly consist of clay, to 13.60m bgl, over chalk, with groundwater being encountered at 13.60m bgl (top of chalk strata).

3.5. Waterbodies / Rivers / Canals

There are no known waterbodies near to the Site. As shown on the OS Water Network Lines Map in Appendix E, the nearest being the 'Main Drain' approximately 750m to the west and the coast approximately 1.5 km to the east.

3.6. Existing Drainage Networks

The Anglian Water asset plan and utilities plan in Appendix E, indicates the surface water run-off from the Site discharges to a 100mm to 225mm diameter surface water network, which is believed to discharge to a 225mm diameter surface water public sewer in Wainfleet Road to the south.

3.7. Surface Water Management Areas

The Site covers an area of approximately 3,960m² / 0.396ha.

Surface water run-off from all the Site, in a pre-development state, discharges to the existing surface water draiange network and public sewer, with a surface water run-off catchment area of **0.396 ha.**

Surface water run-off from most the Site, in a post development state, will also discharge to the existing surface water draiange network and public sewer (via SuDS methods), with a surface water run-off catchment area of 3,880m² / **0.388 ha**. The remaining 80m² / 0.008 ha consists of the small landscape areas, and will discharge off the site at a natural/greenfield rate, and not included in the surface water management calculations.

4. Sources of Flooding

In accordance with the NPPF, flood risk must be assessed for all sources of flooding and development of the Site should be carried out in such a way as to mitigate any potential flood risk to both the Site and third parties and their property. This section identifies all possible sources of flooding.

4.1. Fluvial Flooding

Fluvial flooding results from watercourses / rivers surcharging and flooding the surrounding areas.

4.2. Coastal Flooding

Coastal flooding results from high tides from the sea.

4.3. Pluvial Flooding

‘Pluvial' flooding is that which results from rainfall generated overland flow before the run-off enters any watercourse, drain or sewer. It is more often linked to high intensity rainfall events (typically in excess of 30mm per hour). However, it can also result from lower intensity rainfall or melting snow where the ground is saturated, frozen, developed or has low permeability. This results in overland flow and ponding in depressions in the topography. In urban areas 'pluvial' flows are likely to follow the routes of highways and other surface connectivity to low spots where flooding can occur. In some cases, it can deviate from this route into adjacent developments via dropped kerbs (either for access to driveways or disability access).

4.4. Groundwater Flooding

Groundwater flooding is caused by the emergence of water from sub-surface permeable strata. Fluctuations in the groundwater table can cause flooding should the table rise above the existing ground level. Groundwater flooding events tend to have long durations, lasting days, or weeks.

4.5. Flooding from Drains and Sewers

Flooding from drains and sewers is caused when the capacity of the drains and sewers is exceeded, and will result in flooding from the manholes.

4.6. Canals, Reservoirs and Other Artificial Sources

Flooding from canals, reservoirs and artificial sources is caused when the capacity of the sources are exceeded, or if there is, an infrastructure failure.

5. Sourced Data

Data from the Environment Agency; local strategic flood risk assessments; and information from other parties are to be studied to establish which sources of flooding are at the Site.

5.1. Environment Agency Flood Maps for Planning

The EA fluvial flood zone map shown in Figure 1, indicates that the Site is in Flood Zone 3 (land having a 1% or greater annual probability of river flooding; or Land having a 0.5% or greater annual probability of sea), but benefits from flood defences.

Figure 1 – EA Fluvial Flood Zone Map

The EA fluvial flood probability map shown in Figure 2, indicates the Site has a very low probability of fluvial / coastal flooding. This is due to the Site benefiting from flood defences.

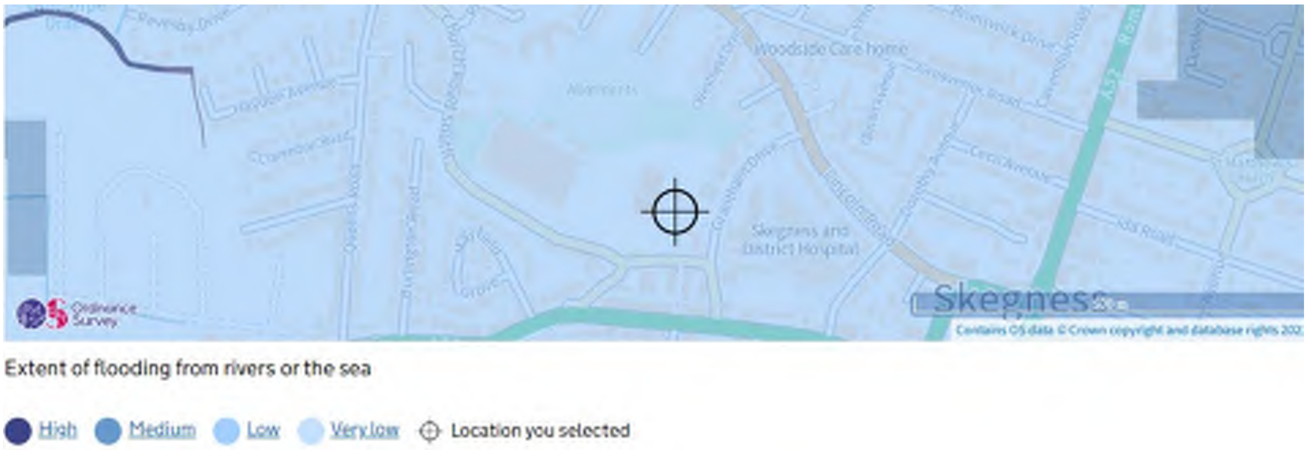


Figure 2 – EA Fluvial Flood Probability Map

The EA pluvial flood probability map shown in Figure 3, indicates the Site has a very low probability of pluvial flooding.

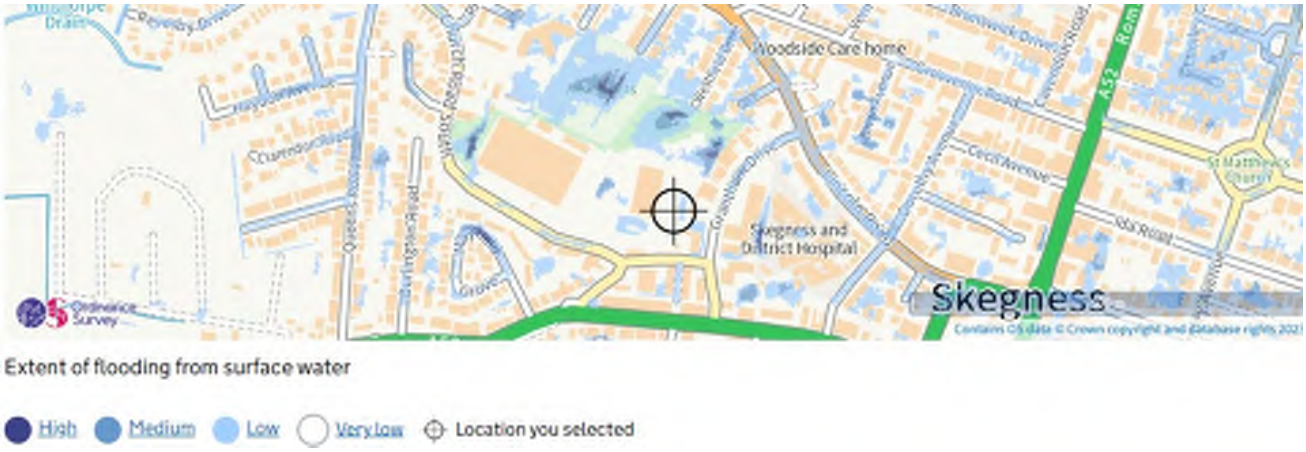


Figure 3 – EA Pluvial Flood Probability Map

The Extents of Flooding from Reservoirs Map in Figure 4 indicates that the Site is not in a flooding area when river levels are normal, or when there is also flooding from rivers.

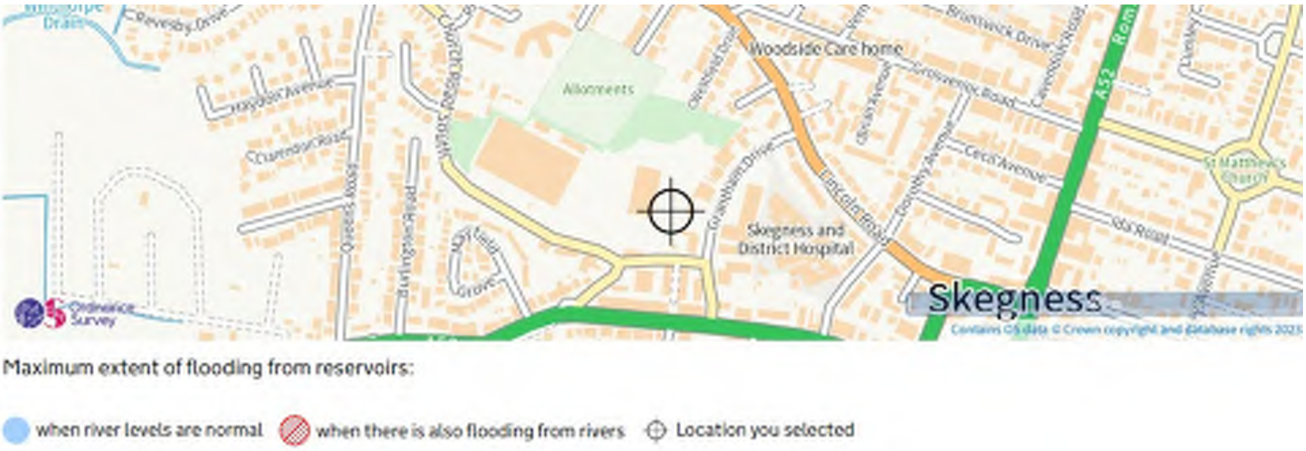


Figure 4 – EA Extents of Flooding from Reservoirs Map

5.2. Landmark Envirocheck Data Maps

Refer to Appendix G for Landmark Envirocheck flood map data. The data shown on the maps have been sourced from studies by JBA Consulting, the EA and NRW. The summary of each of the maps are as follows:

Flood Zone Map

The EA/NRW flood data map also indicates that the Site is in Flood Zone 3 (land having a 1% or greater annual probability of river flooding; or Land having a 0.5% or greater annual probability of sea).

Pluvial, Fluvial and Coastal Flooding

The Envirocheck (JBA) 75-year return period flood map indicates that there is no pluvial or fluvial flooding at the Site, but coastal flooding of depths over 1.0m in an undefended scenario.

The Envirocheck (JBA) 100-year return period flood map indicates that there is no fluvial flooding at the Site, but coastal flooding of depths over 1.0m in an undefended scenario.

The Envirocheck (JBA) 200-year return period flood map indicates that there is no pluvial or fluvial flooding at the Site, but coastal flooding of depths over 1.0m in an undefended scenario.

The Envirocheck (JBA) 1000-year return period flood map indicates that there is no pluvial or fluvial flooding at the Site, but coastal flooding of depths over 1.0m in an undefended scenario.

In summary, the JBA maps indicate that there is no pluvial or fluvial (river) flooding at the Site, but there will be coastal / tidal flooding in an **undefended scenario.**

Surface Water / Pluvial Flooding

The EA 30-year return period flood map indicates that there is no surface water / pluvial flooding at the Site.

The EA 100-year return period flood map indicates that there is no surface water / pluvial flooding at the Site.

The EA 1000-year return period flood map indicates that there is no surface water / pluvial flooding for most the Site area, but with a small, isolated flood area to depths less than 0.15m along the eastern boundary.

Ground Water

The BGS flood data map indicates that there is limited potential for groundwater flooding to occur at the Site.

The ESI groundwater flood map indicates that there is a negligible risk of ground water flooding at the Site.

Canal Failure

The Envirocheck (JBA) canal failure map indicates that the Site is not in the canal flood coverage and will not be in an area of flooding if the event of a canal failure.

Historic Flood Map

The Envirocheck historic flood map indicates that there has been no history of flooding from any source at the Site. The nearest flood event was due to a breach of the tidal defences approximately 500m to the east of the Site to the A52.

5.3. East Lindsey District Council – Strategic Flood Risk Assessment (SFRA)

Tidal Flood Defences

Section 2.9 of the SFRA states:

‘The intensively developed stretch between Mablethorpe and Skegness is an eroding coastline, and the North Sea is held back by hardened defences which are supplemented by a beach nourishment programme (Lincolnshire). This scheme aims to protect against a 1 in 200-year (0.5% in any year) tidal flooding by increasing the level of the breach and reducing the risk of waves reaching the main defenses and going over the seawalls. It protects clay foreshore against further erosion and prevents rapid deterioration of the defences’.

Flood Zone

The SFRA Map 1 also indicates that the Site is in Flood Zone 3 (land having a 1% or greater annual probability of river flooding; or Land having a 0.5% or greater annual probability of sea).

Sea Defence Breach

The SFRA Map 2 identifies the Site to be classified as ‘Danger for Most’ in a modelled 2115 sea defence breach scenario.

6. Probability of Flooding

Now that the extents of the sources of flooding are known from the above data, an assessment is to be made of the probability of flooding from each of the sources.

6.1. Fluvial (Coastal / Tidal) Flood – Probabilities: Defended = Low, Undefended = High

The EA fluvial flood zone map shown in Figure 1, indicates that the Site is in Flood Zone 3 but benefits from flood defences.

The EA fluvial flood probability map shown in Figure 2, indicates the Site has a very low probability of fluvial (coastal / tidal) flooding, due to the Site benefiting from flood defences.

The Envirocheck (JBA) 75-year to 1000-year return period flood map indicates that there is coastal / tidal flooding of depths over 1.0m in an undefended scenario.

Section 2.9 of the SFRA confirms that there are flood defences along the coastline which aims to protect against a 1 in 200-year (0.5% in any year) tidal flooding by increasing the level of the breach and reducing the risk of waves reaching the main defenses and going over the seawalls.

The SFRA Map 2 identifies the Site to be classified as ‘Danger for Most’ in a modelled 2115 sea defence breach scenario.

Therefore, based on the assessed map and data, the Site currently has a low risk of fluvial (coastal / tidal) flooding to the flood defences which are managed and maintained by the EA not to fail.

However, in an unlikely defence breach scenario there will be a high risk of fluvial (coastal / tidal) flooding at the Site, with flood depths being over 1.0m.

6.2. Fluvial (River) Flooding - Probability: Low

The Envirocheck (JBA) 75-year to 1000-year return period flood maps indicate that there is no fluvial flooding from rivers at the Site.

Therefore, the risk of flooding from fluvial (river) sources is deemed to be low.

6.3. Pluvial Flooding - Probability: Low

The EA pluvial flood probability map shown in Figure 3, indicates the Site has a very low probability of pluvial flooding.

The Envirocheck (JBA) 75-year to 1000-year return period flood map indicates that there is no pluvial flooding at the Site.

The EA 30-year to 100-year return period flood map indicates that there is no surface water / pluvial flooding at the Site.

The EA 1000-year return period flood map indicates that there is no surface water / pluvial flooding for most the Site area, but with a small, isolated flood area to depths less than 0.15m along the eastern boundary.

Therefore, as only a small, isolated area of flooding is shown (not from overland flows) during the 1000-year return period only, the Site is deemed to have a low probability of pluvial flooding.

6.4. Ground Water Flooding - Probability: Low

The BGS flood data map indicates that there is limited potential for groundwater flooding to occur at the Site.

The ESI groundwater flood map indicates that there is a negligible risk of ground water flooding at the Site.

Therefore, based on the flood map data, the probability of groundwater flooding at the Site is deemed to be low.

6.5. Flooding from Drains and Sewers - Probability: Low

There are 225mm diameter surface and foul water public sewers in Wainfleet Road to the south. There has been no history of flooding from these sewers, with the sewers being managed and maintained by Anglian Water.

Therefore, the probability of flooding from any drains or sewers is deemed to be low.

6.6. Canals, Reservoirs and Other Artificial Sources - Probability: Low

The Extents of Flooding from Reservoirs Map in Figure 4 indicates that the Site is not in a flooding area when river levels are normal, or when there is also flooding from rivers.

The Envirocheck (JBA) canal failure map indicates that the Site is not in the canal flood coverage and will not be in an area of flooding if the event of a canal failure.

There has also been no history of flooding from any other artificial sources, and therefore, based on the assessed data, the risk of flooding from canals, reservoirs or artificial sources is deemed to be low.

7. Tidal Defences and Breach to the Defences

The assessed flood map and SFRA data identifies the Site not to be affected by any flooding form rivers or other sources, with the only exception being tidal flooding.

The risk of tidal flooding is deemed to be low as there a flood defences along the coast to the east of the Site, which protect the Site from any tidal flooding. The flood defences are managed and maintained by the EA to ensure defects are identified and fixed to maintain the defence.

The Site would be subjected to flooding if a breach of the tidal defences were to occur, with the SFRA identifying the Site to be within a high hazard area, with the flood depths being more than 1.0m.

Flood water in a tidal defence breach will present a significant risk to the patients and staff of the CDC building, and therefore to prevent loss of life the managers of the hospital building will:

- Sign up to the EA Flood Warning system, where they will be altered of potential breach of the flood defences.

  The Flood Warning is usually issued days in advance following a prediction of a high spring tide, low pressure over the North Sea and a north easterly gale. These scenarios could lead to undue pressure on the sea defences causing them to fail.

- Upon flood warning, the CDC building will close until notification of warning has been removed, or post flood event and clean-up.

- Evacuation plan for patients and staff at the time of flood warning prior to the building closing.

Note that due to the potential flooding from tidal sources only, no flood water will be displaced, or the risk of flooding increased to neighbouring land or property once the new CDC building has been erected.

8. 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.

8.1. 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.

8.2. 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).

8.3. 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.

8.4. Peak Surface Water Flow

DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems states:

*‘**S3** For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100-year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event’.*

8.5. Volume Control

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

***S5** Where reasonably practicable, for developments which have been previously developed, 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 must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that 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 S5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk'.*

8.6. Flood Risk within Development

DEFRA 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'.

8.7. 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.

8.8. 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.

9. Surface Water Run-Off Destination

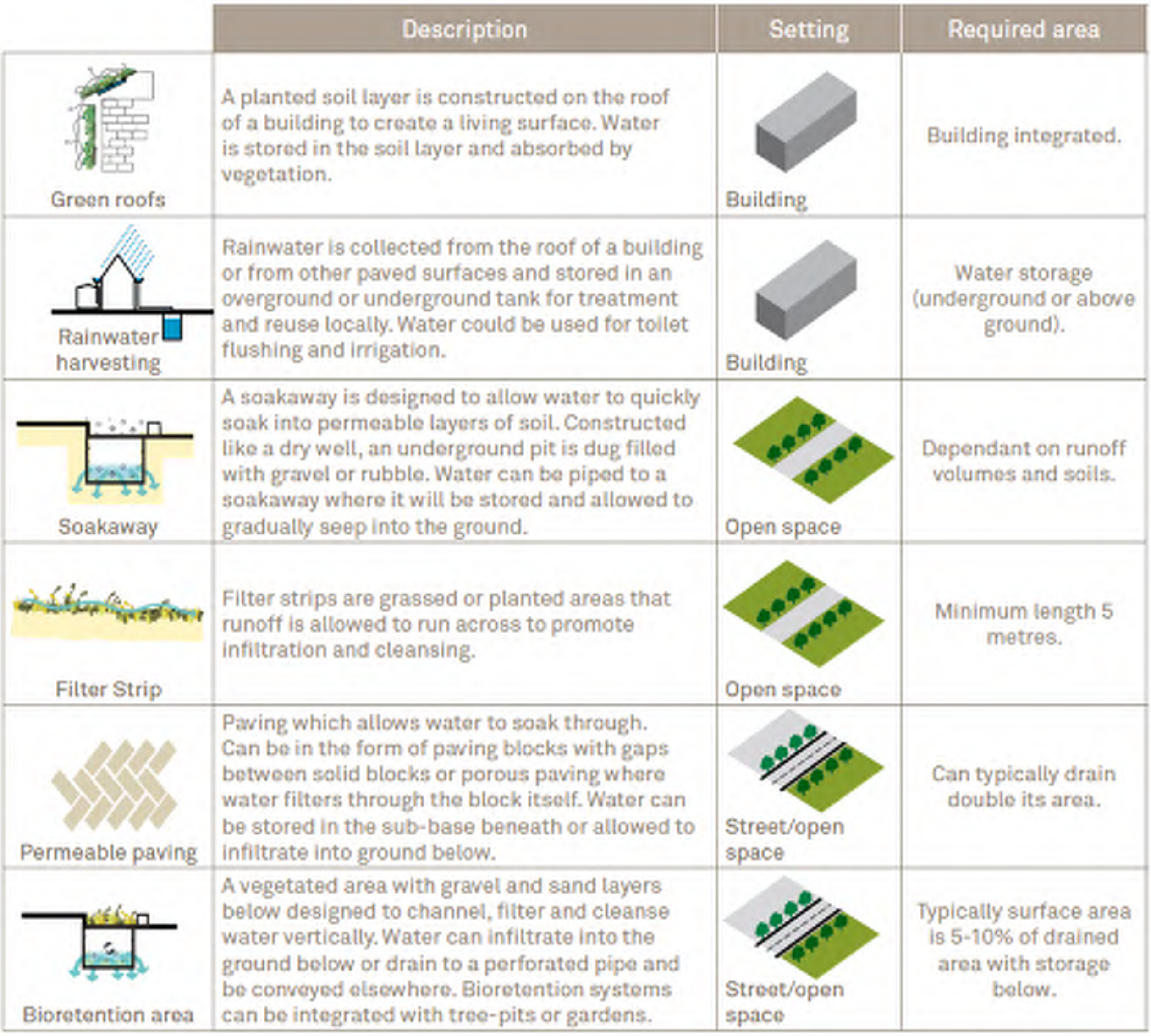
The destination of the surface water run-off from the post development site has been assessed against the prioritisation set by the Approved Document H (2010). The feasibility of the surface water run-off to the priority receptors are as follows:

Run-Off Destination	Feasibility	Description
Discharge to Ground	Not Feasible	BGS data shows borehole logs in an area directly adjacent to the Site, which identifies the ground to predominantly consist of clay to 13.60m bgl, over chalk, with groundwater being encountered at 13.60m bgl (top of chalk strata). Clay is known to have exceptionally low or no infiltration value, and any soakaway structure is to be at least 1.0m above any known groundwater (in accordance with CIRIA 753). Therefore, due to the presence of clay, and the ground water being within the chalk strata, discharge to ground is not feasible.
Discharge to Surface Waterbody	Not Feasible	As shown on the OS Water Network Lines Map (Appendix E), the nearest being the ‘Main Drain’ approximately 750m to the west and the coast approximately 1.5 km to the east. Therefore, discharge to a surface waterbody is not feasible
Discharge to Surface Water Sewer	**Feasible**	As the ground is not feasible for infiltration, and there are no known waterbodies near the site, the only alternative is to discharge to the 225mm surface water sewer in Old Wainfleet Road (south of site) **Discharge to the sewer is believed to replicate the pre-development surface water discharge destination.**
Discharge to Highway or Other Drain	Not Feasible	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	Not Feasible	There are no known combined water sewers near to the development site, and therefore this is not a feasible discharge destination.

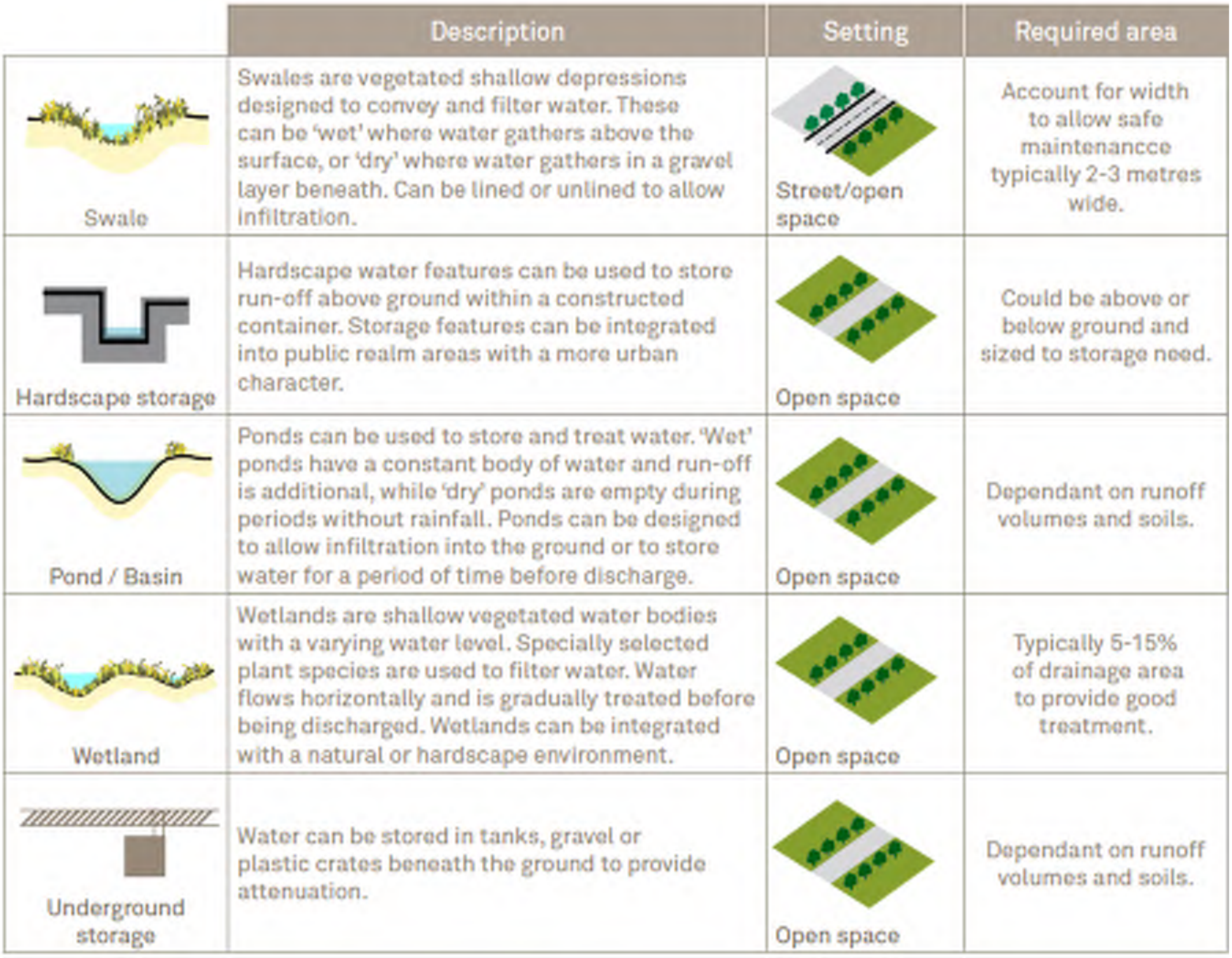
10. SuDS Feasibility

To reduce the surface water run-off, SuDS methods are to be introduced to the post development drainage 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
Green roofs	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.	Building	Building integrated.
Rainwater harvesting	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.	Building	Water storage (underground or above ground).
Soakaway	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.	Open space	Dependant on runoff volumes and soils.
Filter Strip	Filter strips are grassed or planted areas that runoff is allowed to run across to promote infiltration and cleansing.	Open space	Minimum length 5 metres.
Permeable paving	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.	Street/open space	Can typically drain double its area.
Bioretention area	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.	Street/open space	Typically surface area is 5-10% of drained area with storage below.



	Description	Setting	Required area
Swale	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.	Street/open space	Account for width to allow safe maintenancce typically 2-3 metres wide.
Hardscape storage	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.	Open space	Could be above or below ground and sized to storage need.
Pond / Basin	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.	Open space	Dependant on runoff volumes and soils.
Wetland	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.	Open space	Typically 5-15% of drainage area to provide good treatment.
Underground storage	Water can be stored in tanks, gravel or plastic crates beneath the ground to provide attenuation.	Open space	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	**Feasible Use**	**Description**
Living Roofs	No	The new CDC building has not been structural designed for a green roof, and therefore this is not a feasible SuDS method.
Rainwater Harvesting	No	As the CDC building used for medical purposes, water needs to be always available, and therefore the use of rainwater harvesting is not suitable in the event of water shortage. Therefore, this is not a suitable / feasible SuDS method.
Soakaway / Infiltration Structures	No	BGS data shows borehole logs in an area directly adjacent to the Site, which identifies the ground to predominantly consist of clay to 13.60m bgl, over chalk, with groundwater being encountered at 13.60m bgl (top of chalk strata). Clay is known to have exceptionally low or no infiltration value, and any soakaway structure is to be at least 1.0m above any known groundwater (in accordance with CIRIA 753). Therefore, due to the presence of clay, and the ground water being within the chalk strata, the use of soakaways / infiltration structures are not feasible.

Permeable Paving	**Yes**	Permeable paving can be formed in the parking bays of the car park, and will take the surface water run-off form this area and the surrounding access road areas. The paving will be built over a 300mm deep, 20mm no fines sub-base. Surface water won’t discharge directly to ground (potential made ground at formation level) but will be conveyed to the main drainage network via a perforated pipe within the sub-base. The permeable paving will also act as a pollutant control.
Filter Strips	No	Most of the Site will consist of the CSC building, access road, car park with only small areas of landscaping. Therefore, due to the relatively small areas of landscaping, filter drains are not a feasible SuDS method.
Bioretention Areas, Swales / Ponds	No	Most of the Site will consist of the CSC building, access road, car park with only small areas of landscaping. Therefore, due to the relatively small areas of landscaping, bioretention areas, swales and ponds are not a feasible SuDS method.
Underground Storage	**Yes**	The surface water run-off from the development site will be restricted. Therefore, there will be a requirement to have underground storage for storm events up to 1 in 30-year; and to suitable sized so that the volume of water during the 1 in 100-year storm event is kept a minimum at surface level, where it can be contained on site.

11. 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 rates and volume.

11.1. Greenfield Run-Off Rate

The Flood Estimation Handbook (FEH 2013) 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 25km^2, 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 25km^2. 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 km2 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 m^3/s):

QBAR = 0.00108 x AREA0.89 x SAAR1.17 x SOIL2.17

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 = 609

Soil = 0.400

Urban Factor = 0.75 (actual 1.00 – all urban, but 0.75 highest for calculation)

Region Number = 5

The calculations in Appendix H show the rate for 50.00ha is 442.2 l/s, but is to be reduced to reflect the surface water management area (0.388 ha) of the development site. Therefore, the QBAR (greenfield run-off) for development area has been calculated to be:

QBAR = 3.43 l/s (8.84 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 5.

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	3.43 l/s	0.89	**3.1 l/s**
Q_{30}	3.43 l/s	2.55	**8.7 l/s**
Q_{100}	3.43 l/s	3.56	**12.2 l/s**

11.2. 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 H.

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

Site Location = GB 555900 363500 TF 55900 65300

Area = 0.388 ha

SAAR = 612

CWI = 89.16

SPR Host = 47.000

URBTEXT = 0.50 (actual 1.00 – all urban, but 0.50 highest for calculation)

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

$Q_{100\ (6\text{-Hour})}$ = 150.96m³ (389.07m³/ha)

12. Pre-Development Surface Water Run-Off Rates and Volume

The pre-development surface water run-off rates and volume from the pre-development areas are to be calculated, so that the post development rates are at least a betterment.

The calculations to determine the pre-development surface water run-off rates and volume are based on the pre-development surface water run-off area of 0.396 ha, the rainfall data given by the FEH 2013, and simulation / calculations in the MicroDrainage computer software (see Appendix I).

Based on the FEH 2013 data and computer software results, the pre-development surface water run-off rates are as follows:

Q_2 = 85.7 l/s (15-minute storm duration)

Q_{30} = 216.4 l/s (15-minute storm duration)

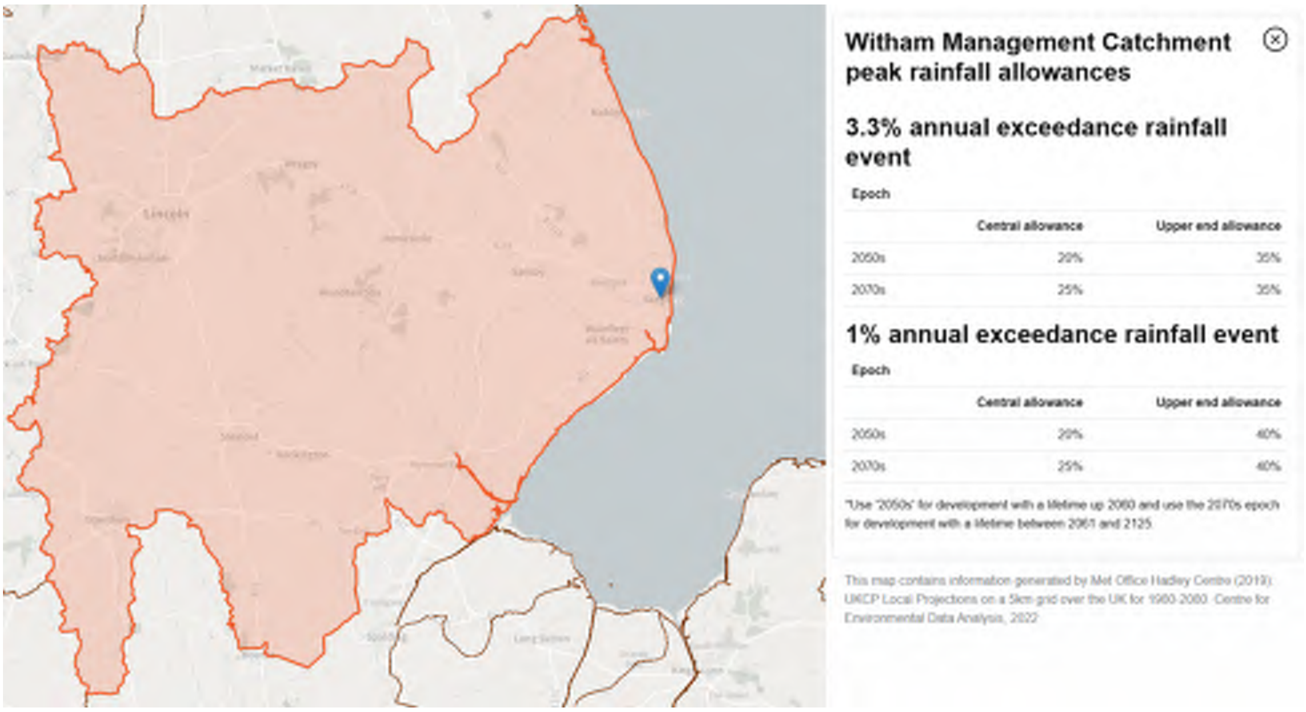
Q_{100} = 270.0 l/s (15-minute storm duration)

The surface water run-off volumes for the pre-development site have also been calculated for 1 in 100-Year the 6-hour duration within the MicroDrainage computer software (Appendix F), where:

$Q_{100\ (6\text{-hour})}$ = 351.10m³

13. 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 5 below.



Witham Management Catchment peak rainfall allowances

3.3% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	20%	35%
2070s	25%	35%

1% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	20%	40%
2070s	25%	40%

"Use '2050s' for development with a lifetime up 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125

This map contains information generated by Met Office Hadley Centre (2019): UKCP Local Projections on a 5km grid over the UK for 1980-2080. Centre for Environmental Data Analysis, 2022

Figure 5 - Department for Environment Food & Rural Affairs – Climate Change Allowances

The lifetime of the Site is likely to be beyond 2061, and therefore the Epoch 2070's is to be used with Upper End Allowance (likelihood of increase rainfall). Therefore, the climate change allowance for the post development Site surface water run-off will be **35%** and **40%** for the 30-year and 100-year event, respectively.

14. Below Ground Drainage Networks and SW Management Calculations

14.1. Surface Water Network Calculations

The calculations to determine the post development surface water run-off rates, volumes and attenuation are based on the surface water run-off area of 0.388 ha, and the rainfall data given by the FEH 2013.

14.2. Surface Water Drainage Network and Management

As shown on the below ground drainage layout drawing in Appendix J, the proposed surface water main network will consist of 150mm to 225mm diameter pipes; 460mm diameter inspection and silt trap chambers; permeable paving systems; a 1200mm diameter flow control chamber containing a hydro-brake; a pollution control chamber; and an attenuation tank in the form of cellular units.

The surface water run-off from the CDC building will discharge to the main network via trapped rainwater pipes; the surface water run-off from the access road will discharge to the main network via trapped gullies; and the surface water ruin-off form the car park area will discharge to the main draiange via the permeable paving.

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 225mm diameter surface water sewer in Old Wainfleet Road

The surface water will surcharge the drainage network when being restricted, and will discharge ‘back’ into cellular units and permeable paving sub-base, where the water will be stored to prevent flooding. Post storm event, the water levels in the SuDS feature will drop, and flow back to the network and through the flow and pollutant control chambers to the existing surface water sewer system.

14.3. Surface Water Run-Off Rate

For the surface water run-off from the Site to be at the greenfield run-off rate, they are to be restricted to 3.1 l/s for the 1 in 2-year storm event; 8.7 l/s for the 1 in 30-year storm event including 35% allowance, and 12.2 l/s for the 1 in 100-year storm event including 40% allowance.

For the surface water run-off to be a reduction of the pre-development rates, the surface water run-off from the Site is to be restricted to less than 85.7 l/s for the 1 in 2-year storm event; 216.4 l/s for the 1 in 30-year storm event including 35% allowance; and 270.0 l/s for the 1 in 100-year storm event including 40% allowance.

For the surface water run-off volume to be a betterment of the greenfield volume (100-year,6-hour storm event), the surface water discharge rates need to be a maximum of 6.9 l/s (150.96m³ x 1000 / 60 x 60 x 6).

For this development, and based on the greenfield rates, pre-development rates, and greenfield volume the suitable / minimum size of the flow control opening (hydro-brake opening) is deemed to be 120mm, with a design rate of 6.9 l/s.

As shown in the output calculation from the MicroDrainage computer software in Appendix K, if the hydro-brake opening is set at 120mm, the design flow at 6.9 l/s, with a design head of 1.20m, the maximum surface water run-off rates for each storm event will be as follows:

Storm	**-**	**Rate**	**-**	**Critical Storm Event**
Q_2	-	6.6 l/s	-	180-minute winter storm duration
$Q_{30+35\%}$	-	6.9 l/s	-	180-minute winter storm duration
$Q_{100+40\%}$	-	7.0 l/s	-	240-minute winter storm duration

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

Greenfield Rate to Post Development Rate

Storm	**-**	**Greenfield**	**-**	**Post Dev**	**-**	**Difference**
Q_{2}	-	3.1 l/s	-	6.6 l/s	-	Increase
$Q_{30+35\%}$	-	8.7 l/s	-	6.9 l/s	-	21% Reduction
$Q_{100+40\%}$	-	12.2 l/s	-	7.0 l/s	-	43% Reduction

Pre-Development Rate to Post Development Rate

Storm	**-**	**Pre-Dev**	**-**	**Post Dev**	**-**	**Difference**
Q_{2}	-	85.7 l/s	-	6.6 l/s	-	92% Reduction
$Q_{30+35\%}$	-	216.4 l/s	-	6.9 l/s	-	97% Reduction
$Q_{100+40\%}$	-	270.0 l/s	-	7.0 l/s	-	97% Reduction

The calculations show that the surface water run-off rates exceed the 2-year greenfield rate, but are a 21% to 43% reduction of the 30-year and 100-year greenfield rate, respectively, and between an 92% to 97% reduction of pre-development rates.

Therefore, they adhere to DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems – S3, where the rates are as close to greenfield rates as possible and are more than a 50% betterment than the pre-development rates.

14.4. Surface Water Run-Off Volume

The post development surface water run-off volume for the Site has also been calculated for 1 in 100-Year the 6-hour duration (Inc. 45% allowance) based on the peak discharge rate (Appendix K), where:

$Q_{100\text{ (6-hour)}}$ - 7.0 l/s x (60x60x6) - 151,200 litres - 151.20m^3

A summary of the post development surface water run-off volume compared to the greenfield and pre-development volumes are as follows:

Greenfield Volume to Post Development Volume

Storm	**-**	**Greenfield**	**-**	**Post Dev**	**-**	**Difference**
Q_{100}	-	150.96m^3	-	151.20m^3	-	Equivalent

Pre-Development Volume to Post Development Volume

Storm	**-**	**Pre-Dev**	**-**	**Post Dev**	**-**	**Difference**
Q_{100}	-	351.10m^3	-	151.20m^3	-	57% Reduction

The surface water run-off volume for the 100-year, 6-hour storm event is equivalent to the greenfield run-off volume, and a 58% reduction of the pre-development volume.

Therefore, the volume still adheres to DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems – S6 (see Section 8.5), where the volume of water is discharged at a rate that does not adversely affect flood risk.

14.5. 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 in the form of cellular units and the sub-base of the permeable paving systems.

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

Cellular Units

Attenuation Tank Length - 30.00m

Attenuation Tank Width - 6.50m

Attenuation Tank Area - 195.00m^2

Attenuation Tank Depth - 1.20m

Porosity - 0.95

Attenuation Tank Volume - **222.30m^3**

Overall Tank Volume - *234.00m^3*

Permeable Paving

Paving / Sub-Base Area - 480.00m^2

Sub-Base Depth - 0.30m

Porosity - 0.30

Attenuation Volume - **43.20m^3**

The MicroDrainage calculations (Appendix H) show that with these SuDS methods and volumes, no flooding will occur for all storms up to and including the 100-year + 40% CC.

15. Maintenance Requirements

The management and maintenance of the surface water drainage networks and SuDS features will be by estate management of the new medical site, where the maintenance of the drainage and SuDS will form part of the overall site management / landscaping / gardening. The details of the management and maintenance to be carried out is as follows:

15.1. 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

15.2. Permeable Paving

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 permeable paving or near system (where may cause risk performance)	Monthly
Rainfall infiltration into raised planter is ensured working effectively.	As required, but at least twice a year

15.3. 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 overall hospital site.

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.

16. Surface Water Design Exceedance

In the unlikely event of an extreme storm greater than 100-year + 40% climate change, or poor maintenance of the SuDS features and / or pipework, potential flooding of the drainage network could occur.

Flood water will follow the existing / proposed topography of the ground and will flow away from the new CDC building and towards the north boundary. Surface water will not flow towards any existing buildings/ properties, but will flow over undeveloped land and into Westfield Drive. Water will be contained in Westfield Drive due to the road having a gradient (flows in channels) and upstand kerbs.

As there are no below ground attenuation structures for the pre-development site (all currently impermeable), any volume discharging off the Site, for any storm event, will always be a reduction of 265.50m^3 (new total attenuation volume). Therefore, the risk of flooding, due to the new below ground attenuation volume, will always be reduced.

17. 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.

Roof and External Areas Pollutant Hazard

C753 Table 26.2 Pollution Hazard Level = Low (Roof) - Medium (External)

C753 Table 26.2 Pollution Hazard Index:

- Total Suspended Solid (TSS) = 0.3 - 0.7
- Metals = 0.2 - 0.6
- Hydrocarbons = 0.05 - 0.7

Pollution Hazard Index = **0.55** - **2.00**

Expansion Roof Pollutant Mitigation

Mitigation Measures:

- **Pollutant Control Chamber (see Appendix L)**

Pollutant Control Chamber Mitigation Indices:

Total Suspended Solid (TSS) = 0.8

Metals = 0.8

Hydrocarbons = 0.8

SuDS Mitigation Indices = **2.40**

The mitigation indices are greater than the pollution hazard index, and therefore suitable water quality is achieved.

18. Development Management and Construction Phase

All existing drainage networks within the development area are to be maintained during construction. The pipe network, cellular units, and flow 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 flooding.

18.1. Construction Environment Management Plan

Full details of the construction environment management plan (CEMP) have to be confirmed by the chosen contractor who have 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:

18.2. Construction Access

The main construction traffic will access the site from the existing road to the south of the Site (Old Wainfleet Road), and will ensure that traffic over the proposed cellular units will be avoided.

18.3. 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.

18.4. 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 silt. Any surface water upstream of the site is to be diverted around the development areas, and to be discharged to the existing drainage system. The surface water run-off destination for the diverted surface water will continue as existing.

18.5. Main Surface Water Run-Off Systems

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

18.6. 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.

18.7. 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.

18.8. 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.

19. Conclusion / Summary

19.1. SuDS Principles and Discharge Destination

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

19.2. Peak Flow Control

The surface water run-off rates exceed the 2-year greenfield rate, but are a 21% to 43% reduction of the 30-year and 100-year greenfield rate, respectively, and between an 92% to 97% reduction of pre-development rates. Therefore, they adhere to DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems – S3, where the rates are as close to greenfield rates as possible and are more than a 50% betterment than the pre-development rates.

19.3. Volume Control

The surface water run-off volume for the 100-year, 6-hour storm event is equivalent to the greenfield run-off volume, and a 58% reduction of the pre-development volume. Therefore, the volume still adheres to DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems – S6 (see Section 8.5), where the volume of water is discharged at a rate that does not adversely affect flood risk.

19.4. Flood Risk within the Development

The MicroDrainage calculations show that with the attenuation tank in the form of cellular unit and the permeable paving sub-base volume of 265.50m³, no flooding will occur for all storms up to and including the 100-year + 40% CC.

19.5. Management and Maintenance

The management and maintenance of the surface water drainage networks and SuDS features will be by estate management of the new medical site, where the maintenance of the drainage and SuDS will form part of the overall site management / landscaping / gardening.

19.6. Exceedance Event

Surface water will be contained within the existing car park area as the levels are relatively flat with slight falls towards the existing gullies. Flood water will not flow directly towards the Site or existing hospital buildings, and as there are no below ground attenuation structures for the pre-development site (all currently impermeable), any volume discharging off the Site, for any storm event, will always be a reduction of 26.40m³. Therefore, the risk of flooding, due to the new below ground attenuation volume, will always be reduced.

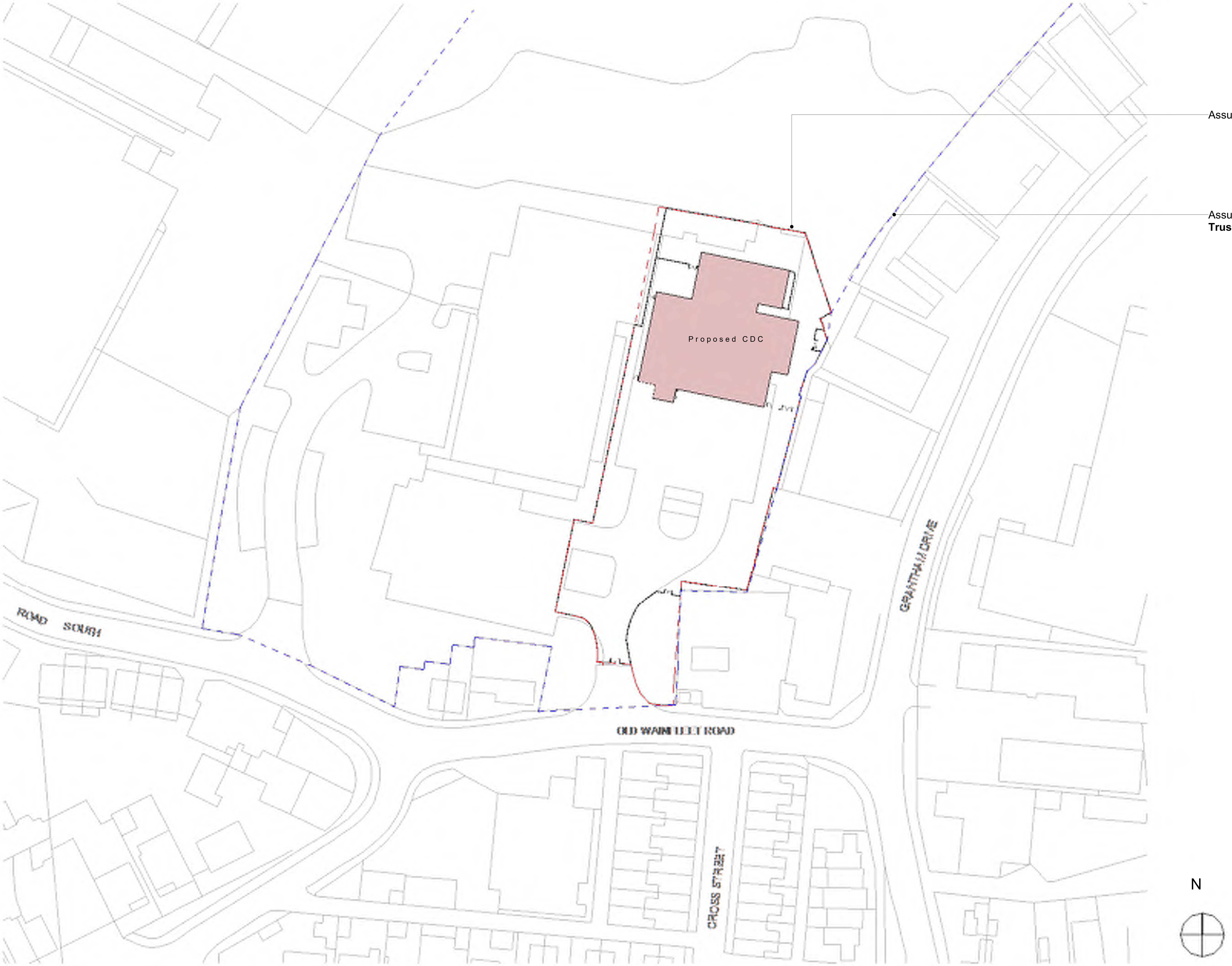
19.7. Water Quality

Flood water will follow the existing / proposed topography of the ground and will flow away from the new CDC building and towards the north boundary. Surface water will not flow towards any existing buildings/ properties, but will flow over undeveloped land and into Westfield Drive. Water will be contained in Westfield Drive due to the road having a gradient (flows in channels) and upstand kerbs.

19.8. Construction Environment Management Plan

All existing drainage networks within the development area are to be maintained during construction. The pipe network, cellular units, and flow 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. Full details of the construction environment management plan (CEMP) has to be confirmed by the chosen contractor who have 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.

Appendix A Site Location Plan



Assumed Site Boundary for CDC Skegness

Assumed Site Ownership Boundary.
Trust to Confirm.

Level 00 - Location Plan
1 : 500

GENERAL NOTES:

DAY Architectural Ltd accepts no responsibility for any costs, losses or claims whatsoever arising from these drawings, specifications and related documents unless there is full compliance with the Client or any unauthorised user of the following:

1 All boundaries, dimensions and levels are to be checked on site before construction and any discrepancies reported to the Architect / Designer.
2 Partial Service: Any discrepancies with site or other information is to be advised to the Architect / Designer and direction and / or approval is to be sought before the implementation of the detail.
3 Block and site plans are reproduced under license from the Ordnance Survey.
4 Do not scale this drawing.
5 For the purpose of coordination, all relevant parties must check this information prior to implementation and report any discrepancies to the Architect / Designer.

REV	DESCRIPTION	DATE	REV BY
A	Stage 2 Information	02.06.23	HG

CLIENT
ULHT

PROJECT
Skegness - CDC

DRAWING
Location Plan

SCALE			FIRST ISSUED
1 : 500 @ A1			04/18/23

PROJECT	CLIENT REF	DRAWN BY	CHECKED BY
1469-23	ULHT	HG	GR

ORIGIN	VOLUME	LEVEL	TYPE	ROLE	NUMBER	REVISION
DAY	XX	XX	DR	A	02-0001	A

DRAWING STATUS
STAGE 2 INFORMATION

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Appendix B Topographical Survey

Survey Notes
Grid: Local plane metric related to National Grid at SC2
Levels: OS datum from GNSS positioning converted using the National Geoid Model OSGM15

Notes
Site covered in caravans, debris and rubbish at time of survey that could be obscuring Utility covers and gullies.

Topographical Survey Legend

BUILDINGS AND WALLS

Building	
Building Open Sided	
Ruin	RUIN
Passage	
Wall with Height	Wall Ht1.3m
Retaining Wall	R/W

FENCE STYLES AND DESCRIPTIONS

Close Boarded	C/B
Corrugated Iron	C/I
Chestnut Paling	C/P
Chainlink	C/L
Handrail	H/R
Interwoven	IWN
Iron Railings	I/R
Lattice	L/F
Miscellaneous	Misc
Palisade	PAL
Post & Chain	P/C
Post & Rail	P/R
Post & Wire	P/W
Post & Barbed Wire	B/W
Wire mesh	W/M
Stile	
Gate	
Fence linestyle	

ROADS

Kerbs	
Edge of Surfacing	
Pedestrian Crossing	PC
Track	Track
Footpath	FP

STREET FURNITURE

Belisha Beacon	BB
Bus Stop	BS
Bollard	B
Cats Eye	CE
Coal Chute	CC
Closed Circuit TV	CCTV
Drain	DR
Electricity Pole	EP
Flood Light	FL
Flag Staff	FS
Lamp Post	LP
Letter Box	LB
Name Plate (street)	NP
Mooring Ring	MR
Mile Post or Mooring Post	MP
Service Marker	MK
Mile Stone	MS
Post	P
Parking Meter	PM
Reflector Post	RP
Rodding Eye	RE
Road Sign	RS
Speed Camera	S/CAM
Information Sign	SIGN
Stay	SY
Traffic Light	TL
Telegraph Pole	TP
Traffic Light Push Button Post	TLP
Traffic Light Control	TLC/P
Control Box	C/BOX
British Telecom Box	BT BOX
Electricity Box	EL BOX
Gas Box	GAS BOX

INSPECTION CHAMBERS AND PIPES

Inspection Cover	IC
Inspection Cover (Elec)	IC/EL
Manhole	MH
British Telecom Cover	BT
Inspection Cover (Comms)	IC/COM
Cable TV	CATV
Inspection Cover Traffic Signals	IC/TL
Gully	G
Kerb Outlet	KO
Vent Pipe	VP
Down Pipe	DP
Rain Water Pipe	RWP
Soil Pipe	SVP
Gas Pipe	G–PIPE
Unable to lift cover	UTL
Stop Tap	ST
Stop Valve	SV
Lamphole	LH
Hydrant	HYD
Earth Rod	ER
Gas Valve	GV
Water Meter	WM
Washout	WO
Rodding Eye	RE

GEOTECHNICAL INFORMATION

Borehole	BH
Trial Pit	TP
Monitor Pin	MON
Probe Hole	PH
Window Sample	WS

GENERAL INFORMATION

Petrol Pump	PP
Basement Light	BL
Footbridge	FB
Dish Type Channel	D.CH
Slot Type Channel	S.CH
Grate Type Channel	G.CH
Tactile Paving	TAC
Crash Barrier	C/BR
Column	COL
Stanchion	STAN
Car Vacuum	VAC
Offset Fill	OF
Air Valve	AV
Trough	TR
Chimney	CHY
Telephone Call Box	TCB

OVERHEAD FEATURES

Electricity Pylon	E.PYLON
Electricity	ETL
Telephone	OTL

WATER FEATURES

Canal	Canal
Stream	Stream
Ditch	Ditch
Weir	Weir
Culvert	Cul
Grip (Land Drain)	
Spring	SPR

RELIEF AND VEGETATION

Hedge	
Edge of wood/Bushes	
Stump	STUMP
Individual Tree	
Slopes with Height Greater than 1m	
Cliff Face	
Marsh	
Reeds	

LEVEL AND HEIGHT INFORMATION

Standard Spot Height	+ 123.45
Precision Spot Height	+ 123.456
Bed Level	+ BL23.92
Water Level	+ WL24.92
Soffit Level	+ SL25.92
Threshold Level	+ TH26.98
Cover Level	+ CL26.45
Invert Level	+ IL25.15
Pipe Soffit Level	+ PSL5.00
Floor Level	+ FL6.00
Finished Floor Level	+ FFL6.00
Top of Tank Level	+ TT7.00
Eave Level	+ EL7.00
Ridge Level	+ RL9.00
Roof Hip Level	+ RHL8.50
Flat Roof Level	+ FRL7.00
Top of Canopy Level	+ TOP/C7.00
Underside of Canopy Level	+ SOF/C6.50
Window Sill Level	+ WSL8.00
Window Head Level	+ WHL9.00
Springing Level	+ SPL8.50
Arch Level	+ AL7.00
Cable Level	+ CHT8.55
Top of Wall Level	+ TWL10.00
Underside of Beam Level	+ UBL9.55
General Height	+ HT9.00

SURVEY INFORMATION SIGNS

Permanent Ground Marker	
O.S. Trig Station	
O.S. Bench Mark	

Sheet Index

Rev.	Date	Description

MALCOLM HUGHES
CHARTERED LAND SURVEYORS

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survey@mhls.co.uk

Accreditations
FS 14126

Client
DAY ARCHITECTURAL LTD
STUDIO 6, SWAN SQUARE, 13 SWAN STREET
MANCHESTER, M4 5JJ

Project
KWIK SAVE SUPERMARKET SITE
OLD WAINFLEET ROAD
SKEGNESS, PE25 3RR

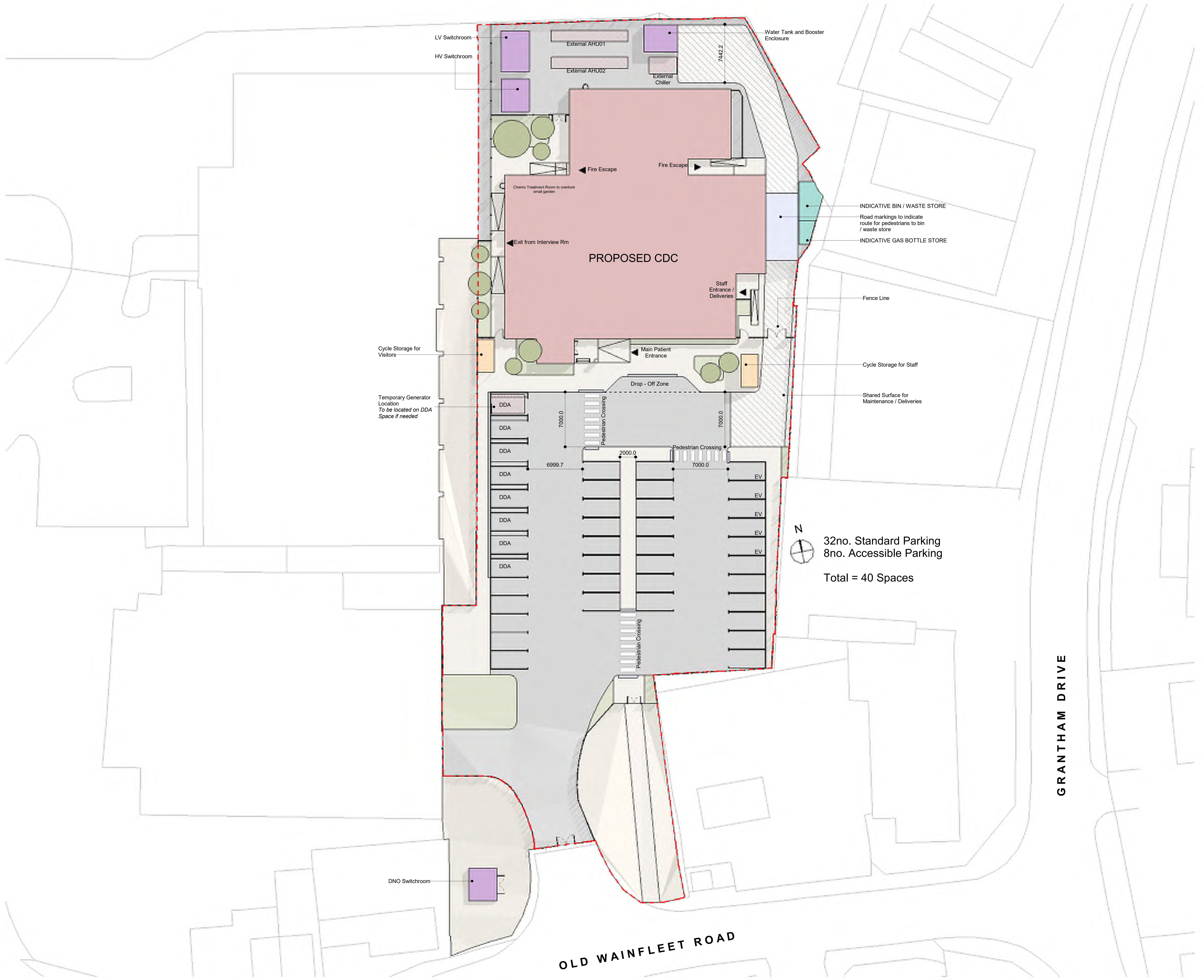
Drawing Title
3D TOPOGRAPHICAL SURVEY

Drawn By	CTC	15/05/23
Checked by	EAD	15/05/23

Survey Date	May 2023
Scale	A0@1:200

Drawing No	60216-1
Revision	

Appendix C Proposed Site Plan



Level 00 - Proposed Site Plan
1 : 200

NOTES

- Co-ordination needed to track Vehicle Movement.
- Topographical Survey Required.
- Co-ordination with MEP to confirm External Plant Room Requirements, GRP location etc.
- Further Clarifcation needed over Site Levels.
- Clarification needed for Site Boundary.
- Confirmation needed for number of EV Points.
- Refer to Drawing 90-0001 for External Works Plan.

SITE PLAN KEY

🟥	Proposed CDC Main Building Footprint
🟪	MEP Requirements GRP Enclosures - Design TBC
▨	MEP Requirements External Locations
🟩	External Bin Store / Gas Bottle Store Indicative - Further Clarification needed from Trust
▨	Proposed New Road / Upgrade to Exisiting Surface
☐	Proposed Pavement
▨	Proposed Shared Surface Area For Maintenance and Deliveries
▨	Proposed Dropped Kerb Locations
🟧	Proposed Cycle Storage

GENERAL NOTES:

DAY Architectural Ltd accepts no responsibility for any costs, losses or claims whatsoever arising from these drawings, specifications and related documents unless there is full compliance with the Client or any unauthorised user of the following:

1 All boundaries, dimensions and levels are to be checked on site before construction and any discrepancies reported to the Architect / Designer.
2 Partial Service: Any discrepancies with site or other information is to be advised to the Architect / Designer and direction and / or approval is to be sought before the implementation of the detail.
3 Block and site plans are reproduced under license from the Ordnance Survey.
4 Do not scale this drawing.
5 For the purpose of coordination, all relevant parties must check this information prior to implementation and report any discrepancies to the Architect / Designer.

REV	DESCRIPTION	DATE	REV BY
D	Stage 2 Information	02.06.23	HG
C	Issued to Design Team	04.05.23	HG
B	Issued to Design Team	27.04.23	HG
A	Amended to Suit Comments	21.04.23	HG

CLIENT
ULHT

PROJECT
Skegness - CDC

DRAWING
Proposed Site Plan

SCALE	FIRST ISSUED
As indicated @ A0	04/18/23

PROJECT	CLIENT REF	DRAWN BY	CHECKED BY
1469-23	ULHT	HG	GR

ORIGIN	VOLUME	LEVEL	TYPE	ROLE	NUMBER	REVISION
DAY	XX	XX	DR	A	02-0002	D

DRAWING STATUS
STAGE 2 INFORMATION

DAY Architectural Ltd.
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2BW

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Appendix D British Geological Survey Data

TF 56SE 41

Norwest Holst Soil Engineering Ltd.

BOREHOLE LOG

5587 6353

Borehole No. **4**

Contract No. F4254
Location Skegness
Client H.F. Dove & Co.
Method of Boring Percussion
Diameter of Borehole 200mm

Sheet 1 of 2
Chainage
Ground Level
Date 8/6/70

Description of Strata	Legend	Depth Below G.L. (m)	Thickness of Strata(m)	Type of sample	C kN/m^2	ϕ deg	m.c. %	γ Mg/m^3	N
MADEGROUND:- ash,concrete, hardcore etc.		0.90	0.90	0.75 I					4
Very soft brown and grey very silty,slightly organic CLAY,with sand pockets.				1.50 ☐	15	0	36	1.78	
				2.75 ☐					
				4.00 ☐	8	0	35	1.90	
		5.60	4.70	5.50 ☐					
Very soft grey organic silty CLAY.				7.00 ☐	7	0	40	1.79	
				8.50 ☐					

Key
☐ Undisturbed Sample
○ Disturbed Sample
△ Water Sample
I Penetration Test
ϕ Angle of Friction
m.c. Moisture Content
γ Bulk Density
N S.P.T. Value
c Apparent Cohesion

Remarks (Observations of Ground Water etc.)
Seepage at 1.50m.
Water struck at 13.30m rising to 4.20m after 20mins
Final standing level 1.45m.

Water levels are subject to seasonal or tidal variations and should not be taken as constant

TF 56 SE 4

Norwest Holst Soil Engineering Ltd.

BOREHOLE LOG

Borehole No. 4

Contract No. E4254
Location Skegness
Client H.F. Dove
Method of Boring Percussion
Diameter of Borehole 200mm

Sheet 2 of 2
Chainage
Ground Level
Date 8/6/79

Description of Strata	Legend	Depth Below G.L. (m)	Thickness of Strata(m)	Type of sample	C kN/m^2	ϕ deg	m.c. %	γ Mg/m^3	N
Very soft grey organic silty CLAY.	▤	11.20	5.60	10.00 ▯					
Stiff brown and grey stony CLAY with chalk pebbles.	▤	13.30	2.10	11.40 ▯	80	14	17	2.14	
				13.00 ▯	No recovery				
Medium dense chalk and flint GRAVEL.	▨	15.20	1.90	13.50 I					19
				15.00 I					30
Hard white CHALK.	▦	18.15		15.50 I					72 for 135mm
				17.00 I					79 for 120mm
				18.00 I					76 for 125mm

Key
▯ Undisturbed Sample
○ Disturbed Sample
△ Water Sample
I Penetration Test
ϕ Angle of Friction
m.c. Moisture Content
γ Bulk Density
N S.P.T. Value
C Apparent Cohesion

Remarks (Observations of Ground Water etc.)

Water levels are subject to seasonal or tidal variations and should not be taken as constant

TF 56 SE 40

Norwest Holst Soil Engineering Ltd.
BOREHOLE LOG

Borehole No. **3**

5584 6351

Contract No. F4254
Location Skegness
Client H.F. Dove & Co
Method of Boring Percussion
Diameter of Borehole 200mm

Sheet 1 of 1
Chainage
Ground Level
Date 12/6/79

Description of Strata	Legend	Depth Below G.L. (m)	Thickness of Strata(m)	Type of sample	C kN/m^2	ϕ deg	m.c. %	γ Mg/m^3	N
MADEGROUND:- topsoil,hardcore etc.	▩	0.85	0.85	0.75 I					8
Very soft brown and grey slightly organic silty CLAY.	▤	2.50	1.65	1.75 ☐	20	7	35	1.81	
Black clayey PEAT.	∴	2.90	0.40	2.75 ☐	9	0	45	1.79	
Very soft grey organic silty CLAY.	▤	6.00		4.00 ☐ 5.50 ☐					

Key
☐ Undisturbed Sample
○ Disturbed Sample
△ Water Sample
I Penetration Test
ϕ Angle of Friction
m.c. Moisture Content
γ Bulk Density
N S.P.T. Value
C Apparent Cohesion

Remarks (Observations of Ground Water etc.)
Slight seepage at 1.50m.

Water levels are subject to seasonal or tidal variations and should not be taken as constant

TF 56 SE 39

Norwest Holst Soil Engineering Ltd.
BOREHOLE LOG

SS84 6348

Borehole No. 1

Contract No. F4254
Location Skegness
Client H.F. Dove & Co
Method of Boring Percussion
Diameter of Borehole 200mm

Sheet 1 of 2
Chainage
Ground Level
Date 6/6/79

Description of Strata	Legend	Depth Below G.L. (m)	Thickness of Strata(m)	Type of sample	C kN/m^2	ϕ deg	m.c. %	γ Mg/m^3	N
MADEGROUND:- Concrete and brick rubble.	▨	0.60	0.60						
Very soft brown and grey very silty, slightly organic CLAY.	▤			0.75 □	13	0	36	1.77	
				1.75 □					
				2.75 □	9	0	32	2.08	
				4.00 □					
		4.90	4.30						
Very soft grey silty organic CLAY.	▤			5.50 □	9	0	59	1.62	
				7.00 □					
				8.50 □	8	0	40	1.84	

Key
□ Undisturbed Sample
○ Disturbed Sample
△ Water Sample
I Penetration Test
ϕ Angle of Friction
m.c. Moisture Content
γ Bulk Density
N S.P.T. Value
C Apparent Cohesion

Remarks (Observations of Ground Water etc.)
Slight seepage at 0.40m
Water struck at 5.40m rising to 5.00m after 20mins
Struck again at 13.60m " " 3.90m " " "
Standing AM at 2.30m
Final standing level 0.80m

Water levels are subject to seasonal or tidal variations and should not be taken as constant

TF 56 SE 34

Norwest Holst Soil Engineering Ltd.

BOREHOLE LOG

Borehole No. 1

Contract No. F4254
Location Skegness
Client H.F. Dove & Co
Method of Boring Percussion
Diameter of Borehole 200mm

Sheet 2 of 2
Chainage
Ground Level
Date 6/6/79

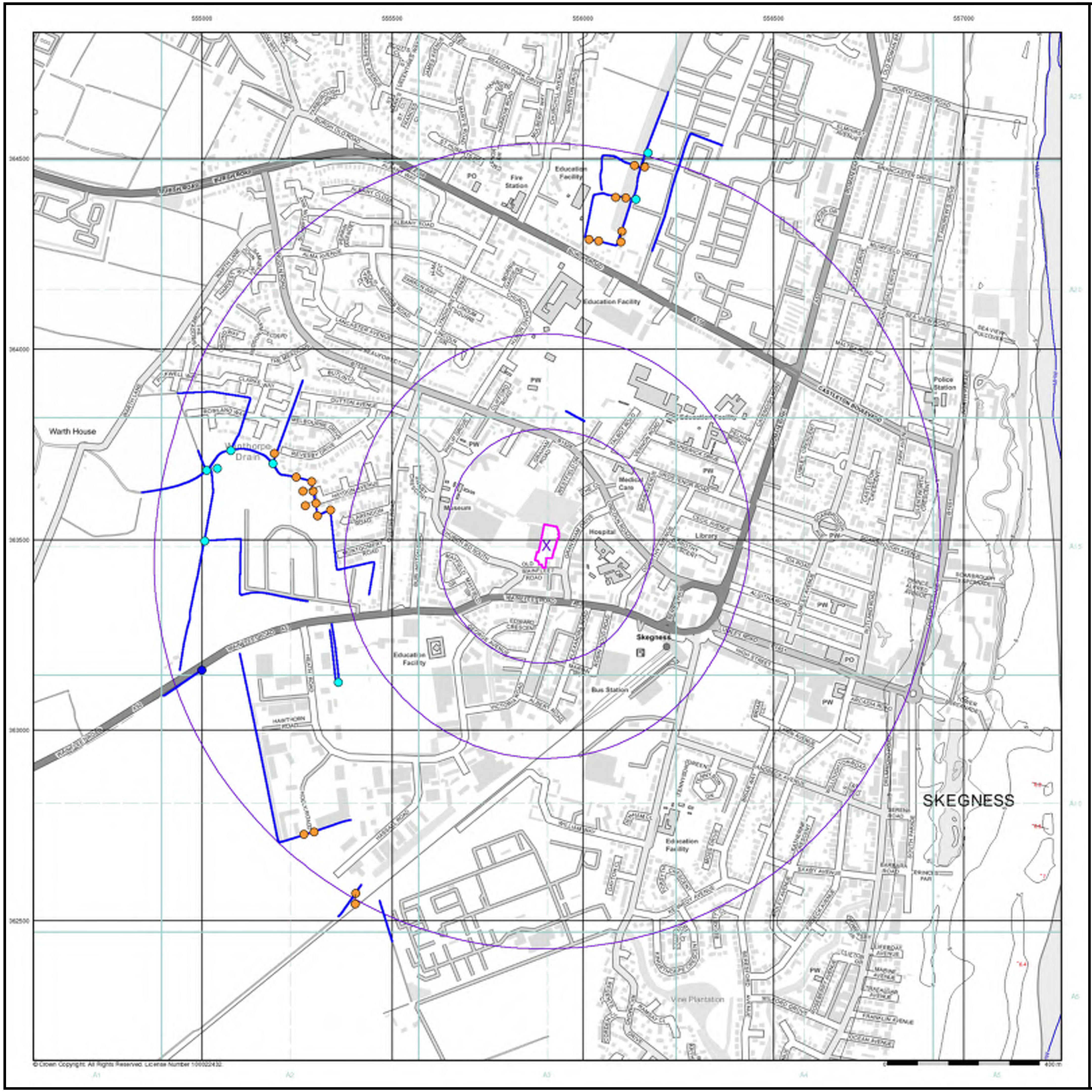
Description of Strata	Legend	Depth Below G.L. (m)	Thickness of Strata (m)	Type of sample	C kN/m²	φ deg	m.c. %	γ Mg/m³	N
		10.30	5.40	10.05 ☐					
Stiff brown and grey stony CLAY with chalk pebbles.					15	0	25	1.94	
				11.50 ☐	90	11	12	2.15	
		12.90	2.60						
Firm brown sandy stony CLAY.				13.00 ☐	69	0	19	2.07	
		13.60	0.70	13.60					
Medium dense chalk and flint GRAVEL.				I					17
				15.00 I					
		15.30	1.70						39
Weathered grey/brown CHALK.				16.00 I					75 for 150mm
		16.80	1.50						
Hard white CHALK.				17.00 I					116 for 200mm
				18.00 I					81 for 125mm
		18.15							

Key
☐ Undisturbed Sample
○ Disturbed Sample
△ Water Sample
I Penetration Test
φ Angle of Friction
m.c. Moisture Content
γ Bulk Density
N S.P.T. Value
c Apparent Cohesion

Remarks (Observations of Ground Water etc.)

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Appendix E OS Water Network Map



Envirocheck®

LANDMARK INFORMATION GROUP®

OS Water Network Lines Map (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

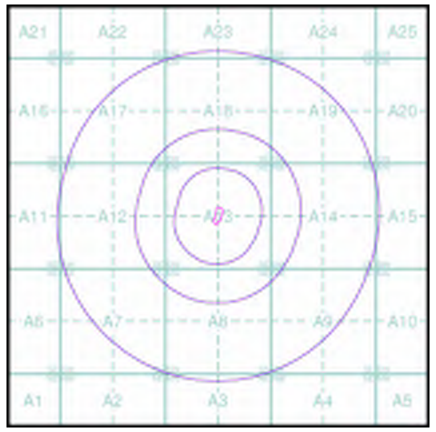
OS Water Network Data

Canal	Drain
Reservoir	Other
Foreshore	Lake
Marsh	Transfer
Tidal River	Lock Or Flight Of Locks
Inland River	Sea
● Junction	● Source
● Outlet	● Other
● Pseudo	

Contours (height in meters)

Standard Contour	Mean Low Water
Master Contour	Mean High Water
Spot Height	

OS Water Network Map - Slice A



N

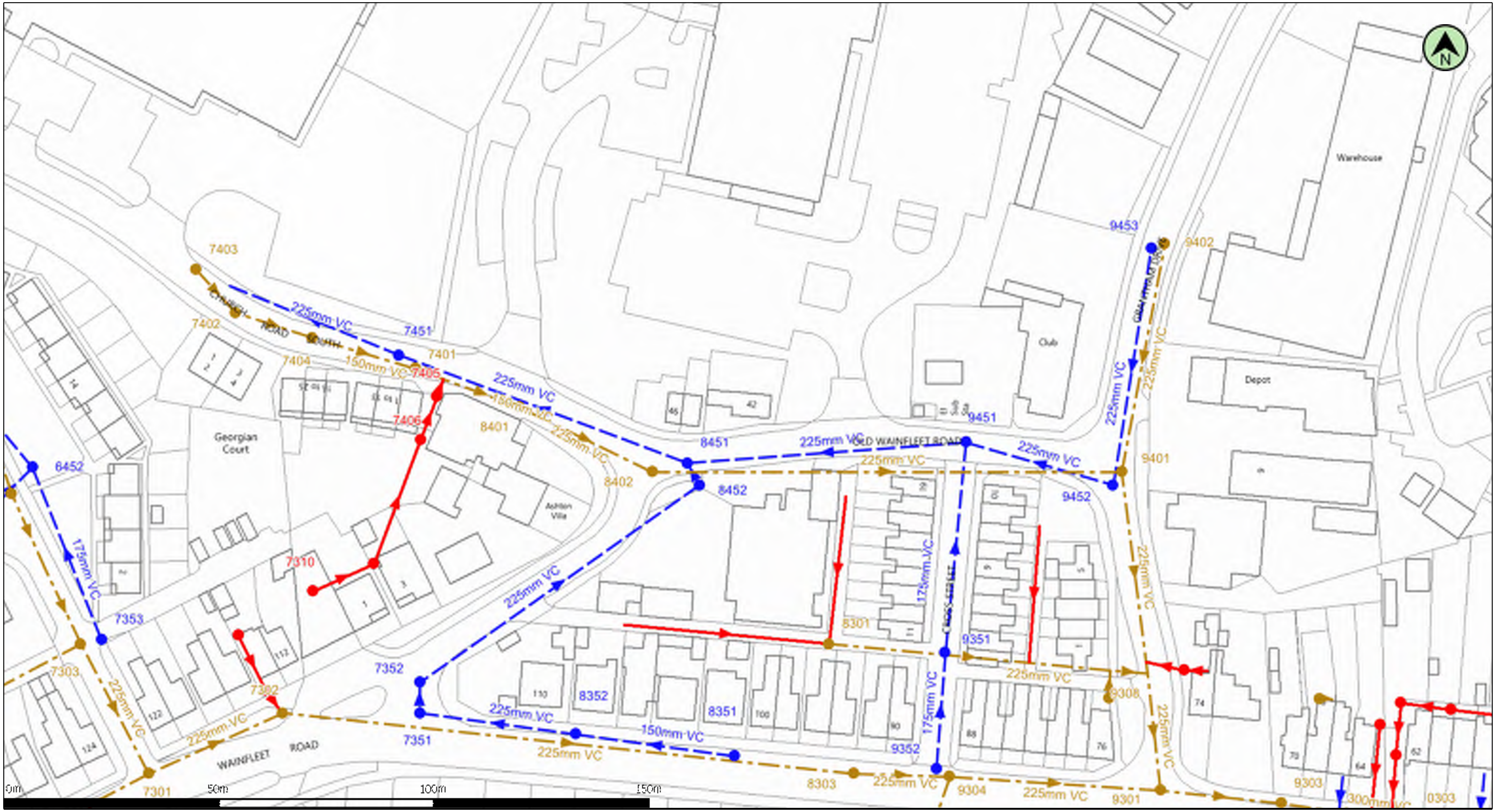
Order Details

Order Number:	313324259_1_1
Customer Ref:	950
National Grid Reference:	555910, 363490
Slice:	A
Site Area (Ha):	0.4
Search Buffer (m):	1000

Site Details

Site at 555900, 363500

Appendix F Existing Drainage Plans



(c) Crown copyright and database rights 2023 Ordnance Survey 100022432 | Date: 27/06/23 | Scale: 1:1250 | Map Centre: 555864,363428 | Data updated: 31/05/23 | Our Ref: 1211241 - 1 | Wastewater Plan A4

This plan is provided by Anglian Water pursuant its obligations under the Water Industry Act 1991 sections 198 or 199. It must be used in conjunction with any search results attached. The information on this plan is based on data currently recorded but position must be regarded as approximate. Service pipes, private sewers and drains are generally not shown. Users of this map are strongly advised to commission their own survey of the area shown on the plan before carrying out any works. The actual position of all apparatus MUST be established by trial holes. No liability whatsoever, including liability for negligence, is accepted by Anglian Water for any error or inaccuracy or omission, including the failure to accurately record, or record at all, the location of any water main, discharge pipe, sewer or disposal main or any item of apparatus. This information is valid for the date printed. This plan is produced by Anglian Water Services Limited (c) Crown copyright and database rights 2023 Ordnance Survey 100022432.This map is to be used for the purposes of viewing the location of Anglian Water plant only. Any other uses of the map data or further copies is not permitted. This notice is not intended to exclude or restrict liability for death or personal injury resulting from negligence.

Foul Sewer
Surface Sewer
Combined Sewer
Final Effluent
Rising Main*
Private Sewer*
Decommissioned Sewer*

Outfall*
Inlet*
Manhole*

Sewage Treatment Works
Public Pumping Station
Decomissioned Pumping Station
*(Colour denotes effluent type)

mark@flo-consult.co.uk

Skegness CDC

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
7310	C	-	-	-
7405	C	-	-	-
7406	C	-	-	-
6401	F	2.56	1.38	1.18
7301	F	3.76	1.1	2.66
7302	F	3.9	0.96	2.94
7303	F	2.75	1.2	1.55
7401	F	2.89	2.04	0.85
7402	F	2.92	2.45	0.47
7403	F	-	-	-
7404	F	-	-	-
8301	F	3.27	1.66	1.61
8303	F	3.7	0.56	3.14
8401	F	3.09	1.86	1.23
8402	F	3.54	1.78	1.76
9301	F	3.62	0.28	3.34
9303	F	3.48	0.09	3.39
9304	F	3.65	0.45	3.2
9308	F	-	-	-
9401	F	3.48	0.87	2.61
9402	F	2.56	1.26	1.3
6452	S	2.61	1.7	0.91
7351	S	3.61	1.85	1.76
7352	S	3.61	1.82	1.79
7353	S	2.67	1.83	0.84
7451	S	2.87	1.45	1.42
8351	S	3.52	2.77	0.75
8352	S	-	-	-
8451	S	3.55	1.59	1.96
8452	S	3.57	1.6	1.97
9351	S	3.4	2.2	1.2
9352	S	3.62	2.45	1.17
9451	S	3.5	1.77	1.73
9452	S	3.495	1.84	1.655
9453	S	2.59	1.89	0.7

Our Ref: 1211241 - 1

UNDERGROUND SERVICES KEY

TEL(B2)	British Telecom
COM(B2)	Communications Cable
ED(B2)	Empty Ducting
E(B2)	Electricity Cables
G(B2)	Gas Pipes
CWS(B2)	Sewer Combined
FWS(B2)	Sewer Foul
SWS(B2)	Sewer Surface Water
TL(B2)	Traffic Light Cables
U(B2)	Unidentified GPR or electro location trace
W(B2)	Water pipes
⊸	End of trace
🟩	Services survey boundary
■	Area of No Access
■	GPR Detected Anomaly
▨	GPR Detected Rebar
▩	GPR Detected Structural Feature
▨	GPR Detected Structure
░	GPR Low Data

AR	Assumed Route	GPR	Ground Penetrating Radar
BD	Backdrop	TFR	Taken From Records
CR	Cable Riser	PE	Polyethylene Pipe
d	Depth	UTS	Unable To Survey
PR	Pipe Riser	UR	Unable To Rod
RS	Reducing Slab (Drainage)	UT	Unable To Trace
T	Tank	NVP	No Visible Pipes
VR	Vapour Recovery Point	VC	Vitrified Clay
UTL	Unable To Lift	CO	Concrete

DISCLAIMER

Electromagnetic and ground penetrating radar techniques have been used in the location of underground services shown on this survey plan. These are interpretive procedures and we recommend that trial excavations should be undertaken to to confirm identification, location and depth of services where these are critical.

Please note that not all buried pipes, cable and ducts can be detected and mapped in consideration of their depth, location, material type, geology and proximity to other utilities.

All reasonable effort and care has been made in searching available record drawings. The completeness of the underground service information supplied to and by us cannot be guaranteed.

BSI PAS128:2014 QUALITY LEVELS

(A) = Verified by Inspection-trial pit, vacuum Excavation, Inspection Chamber/Manhole

(B1) = Detected with GPR & EML-High confidence position and depth

(B2) = Detected with either GPR or EML-Medium confidence position and depth

(B3) = Detected with GPR or EML (no depth - poor signal)

(B4) = Assumed route - Not detected - interpreted route

(C) = Record data located to Street Furniture - not detected

(D) = Record data not located- not detected

(P) = Post processed

NB: QL(A) is inferred at all MHs ICs etc. unless otherwise stated.

NOTES

Where services are non-metallic or not proven on site, positions are taken from records, trench scars & surface detail.

Where stated, depth estimations are typically to the centre or top of the service. Depths to gravity sewers and drains are typically to invert levels, unless otherwise stated.

Where Ground Penetrating Radar (GPR) is quoted the depth is recorded to the assumed external crown of the feature.

The diagram below describes the depth information in more detail.

Where the precise position or depths of these features are critical to the design or siteworks they must be verified by the use of trial excavations.

Pipe sizes which cannot be obtained by visual survey are taken from utilities record drawings or marker plates where available.

Services shown as Taken From Records have not been proven on site.

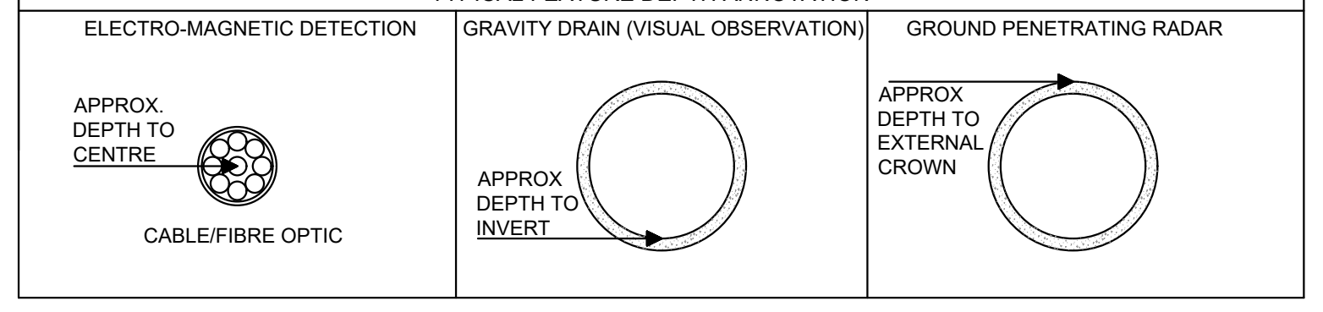
The CAD layering may contain further information.

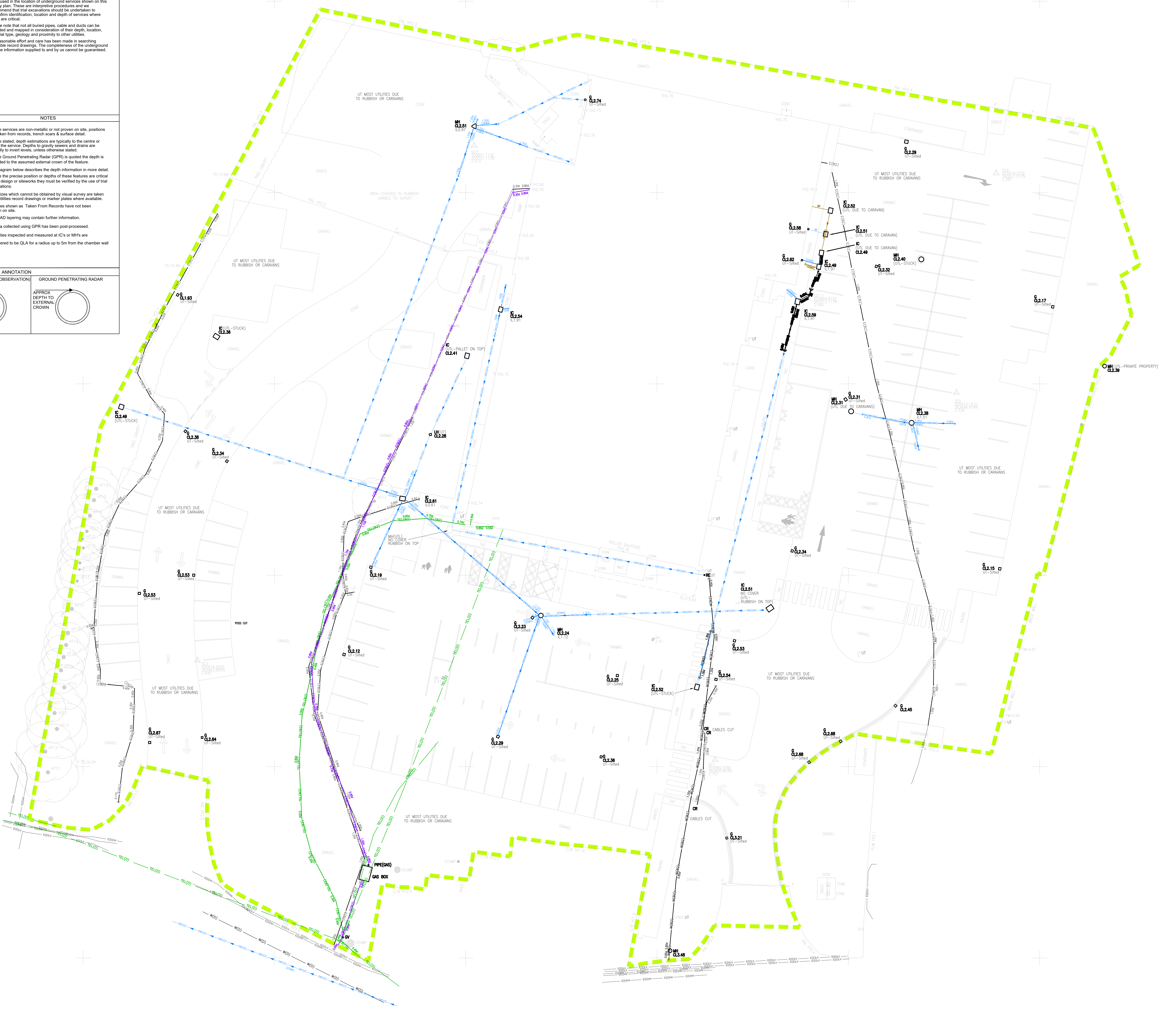
All data collected using GPR has been post-processed.

All utilities inspected and measured at IC's or MH's are

considered to be QLA for a radius up to 5m from the chamber wall

TYPICAL FEATURE DEPTH ANNOTATION





Survey Notes

Grid: Local plane metric related to National Grid at SC2

Levels: OS datum from GNSS positioning converted using the National Geoid Model OSGM15

Notes

Site covered in caravans, debris and rubbish at time of survey that could be obscuring Utility covers and gullies.

Topographical Survey Legend

BUILDINGS AND WALLS

Building	
Building Open Sided	
Ruin	RUIN
Passage	
Wall with Height	Wall Ht1.3m
Retaining Wall	R/W

FENCE STYLES AND DESCRIPTIONS

Close Boarded	C/B
Corrugated Iron	C/I
Chestnut Paling	C/P
Chainlink	C/L
Handrail	H/R
Interwoven	IWN
Iron Railings	I/R
Lattice	L/F
Miscellaneous	Misc
Palisade	PAL
Post & Chain	P/C
Post & Rail	P/R
Post & Wire	P/W
Post & Barbed Wire	B/W
Wire mesh	W/M
Stile	
Gate	
Fence linestyle	

ROADS

Kerbs	
Edge of Surfacing	
Pedestrian Crossing	PC
Track	Track
Footpath	FP

STREET FURNITURE

Belisha Beacon	BB
Bus Stop	BS
Bollard	B
Cats Eye	CE
Coal Chute	CC
Closed Circuit TV	CCTV
Drain	DR
Electricity Pole	EP
Flood Light	FL
Flag Staff	FS
Lamp Post	LP
Letter Box	LB
Name Plate (street)	NP
Mooring Ring	MR
Mile Post or Mooring Post	MP
Service Marker	MK
Mile Stone	MS
Post	P
Parking Meter	PM
Reflector Post	RP
Rodding Eye	RE
Road Sign	RS
Speed Camera	S/CAM
Information Sign	SIGN
Stay	SY
Traffic Light	TL
Telegraph Pole	TP
Traffic Light Push Button Post	TLP
Traffic Light Control	TLC/P
Control Box	C/BOX
British Telecom Box	BT BOX
Electricity Box	EL BOX
Gas Box	GAS BOX

INSPECTION CHAMBERS AND PIPES

Inspection Cover	IC
Inspection Cover (Elec)	IC/EL
Manhole	MH
British Telecom Cover	BT
Inspection Cover (Comms)	IC/COM
Cable TV	CATV
Inspection Cover Traffic Signals	IC/TL
Gully	G
Kerb Outlet	KO
Vent Pipe	VP
Down Pipe	DP
Rain Water Pipe	RWP
Soil Pipe	SVP
Gas Pipe	G–PIPE
Unable to lift cover	UTL
Stop Tap	ST
Stop Valve	SV
Lamphole	LH
Hydrant	HYD
Earth Rod	ER
Gas Valve	GV
Water Meter	WM
Washout	WO
Rodding Eye	RE

GEOTECHNICAL INFORMATION

Borehole	BH
Trial Pit	TP
Monitor Pin	MON
Probe Hole	PH
Window Sample	WS

GENERAL INFORMATION

Petrol Pump	PP
Basement Light	BL
Footbridge	FB
Dish Type Channel	D.CH
Slot Type Channel	S.CH
Grate Type Channel	G.CH
Tactile Paving	TAC
Crash Barrier	C/BR
Column	COL
Stanchion	STAN
Car Vacuum	VAC
Offset Fill	OF
Air Valve	AV
Trough	TR
Chimney	CHY
Telephone Call Box	TCB

OVERHEAD FEATURES

Electricity Pylon	E.PYLON
Electricity	ETL
Telephone	OTL

WATER FEATURES

Canal	Canal
Stream	Stream
Ditch	Ditch
Weir	Weir
Culvert	Cul
Grip (Land Drain)	=======
Spring	SPR

RELIEF AND VEGETATION

Hedge	
Edge of wood/Bushes	
Stump	STUMP
Individual Tree	
Slopes with Height Greater than 1m	
Cliff Face	
Marsh	
Reeds	

LEVEL AND HEIGHT INFORMATION

Standard Spot Height	+123.45
Precision Spot Height	+123.456
Bed Level	+BL23.92
Water Level	+WL24.92
Soffit Level	+SL25.92
Threshold Level	+TH26.98
Cover Level	+CL26.45
Invert Level	+IL25.15
Pipe Soffit Level	+PSL5.00
Floor Level	+FL6.00
Finished Floor Level	+FFL6.00
Top of Tank Level	+TT7.00
Eave Level	+EL7.00
Ridge Level	+RL9.00
Roof Hip Level	+RHL8.50
Flat Roof Level	+FRL7.00
Top of Canopy Level	+TOP/C7.00
Underside of Canopy Level	+SOF/C6.50
Window Sill Level	+WSL8.00
Window Head Level	+WHL9.00
Springing Level	+SPL8.50
Arch Level	+AL7.00
Cable Level	+CHT8.55
Top of Wall Level	+TWL10.00
Underside of Beam Level	+UBL9.55
General Height	+HT9.00

SURVEY INFORMATION SIGNS

- Permanent Ground Marker
- O.S. Trig Station
- O.S. Bench Mark

Sheet Index

Rev.	Date	Description

MALCOLM HUGHES
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RICS
THE SURVEY ASSOCIATION
chartered ices
QUALIFIED
ISO 9001 Quality Management
FS 14126

Client

DAY ARCHITECTURAL LTD
STUDIO 6, SWAN SQUARE, 13 SWAN STREET
MANCHESTER, M4 5JJ

Project

KWIK SAVE SUPERMARKET SITE
OLD WAINFLEET ROAD
SKEGNESS, PE25 3RR

Drawing Title

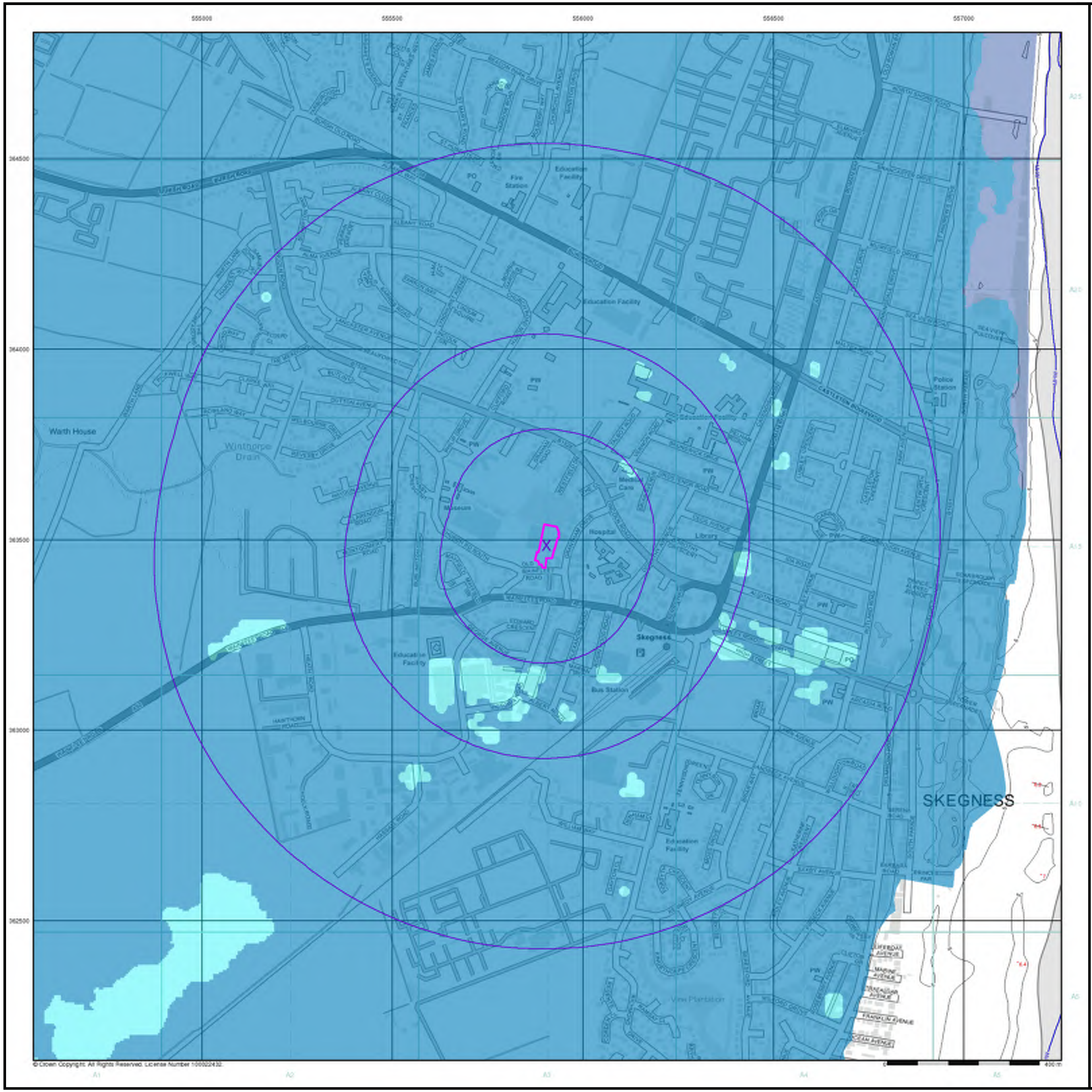
UTILITY SURVEY

Drawn By CTC 25/05/23
Checked by DJ 25/05/23

Survey Date May 2023
Scale A0@1:200

Drawing No 60216-UG1
Revision

Appendix G Landmark EnviroCheck Flood Maps



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EA/NRW Flood Data Map (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

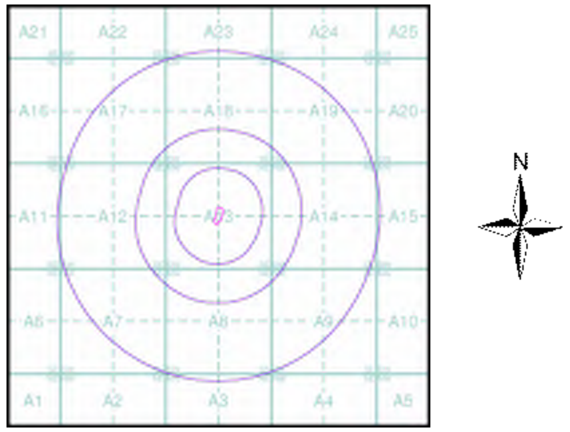
Flood Data

- ■ Extreme Flooding from Rivers or Sea without Defences (Zone 2)
- ■ Flooding from Rivers or Sea without Defences (Zone 3)
- ▨ Area Benefiting from Flood Defence
- ⬚ Flood Water Storage Areas
- -·- Flood Defence

Contours (height in metres)

- Standard Contour 105
- Master Contour 100 95
- Spot Height 167.8
- MLW Mean Low Water
- MHW Mean High Water

EA/NRW Flood Data Map - Slice A



Order Details

Order Number:	313324259_1_1
Customer Ref:	950
National Grid Reference:	555910, 363490
Slice:	A
Site Area (Ha):	0.4
Search Buffer (m):	1000

Site Details

Site at 555900, 363500

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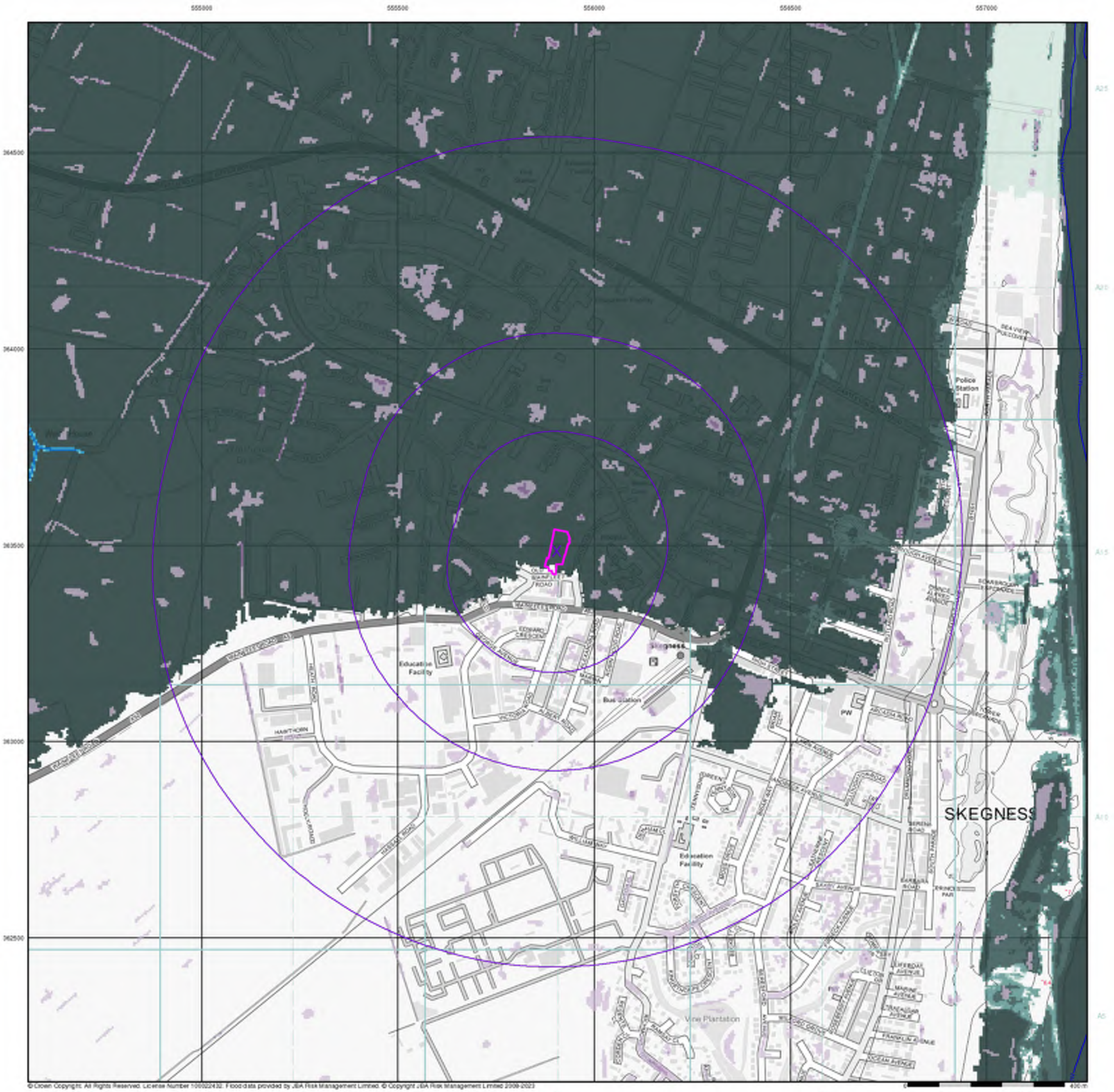

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JBA 75 Year Return Flood Map (Undefended) (1:10,000)

General

Specified Site
Specified Buffer(s)
X Bearing Reference Point

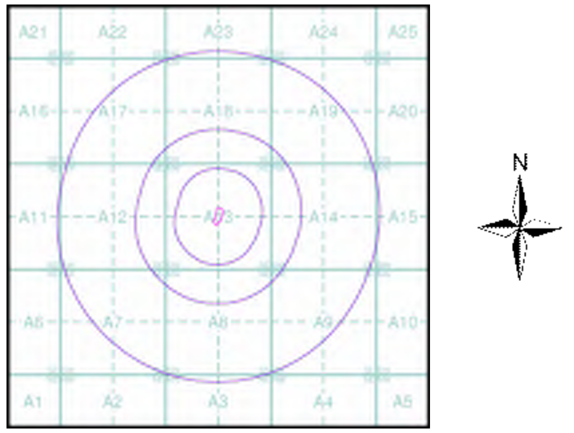
Modelled Flood Depth

Pluvial Depth	Fluvial Depth	Coastal Depth
0.1m	0.01m - 0.05m	0.01m - 0.05m
0.1m - 0.3m	0.05m - 0.1m	0.05m - 0.1m
0.3m - 1m	0.1m - 0.3m	0.1m - 0.3m
>1m	0.3m - 1m	0.3m - 1m
	>1m	>1m

Contours (height in metres)

Standard Contour
Master Contour
Spot Height
MLW Mean Low Water
MHW Mean High Water

JBA 75 Year Return Flood Map (Undefended) - Slice A



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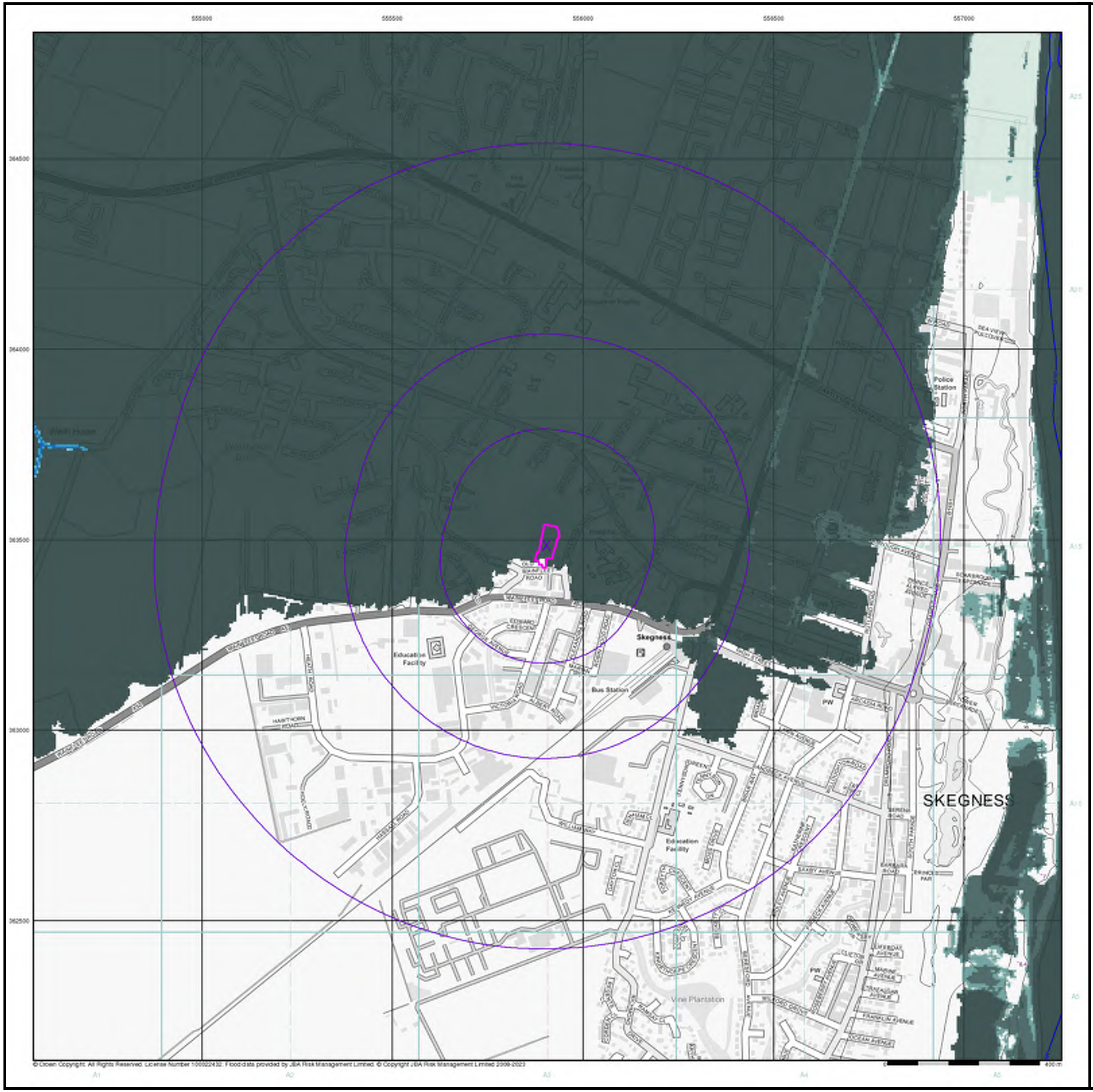

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JBA 100 Year Return Flood Map (Undefended) (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

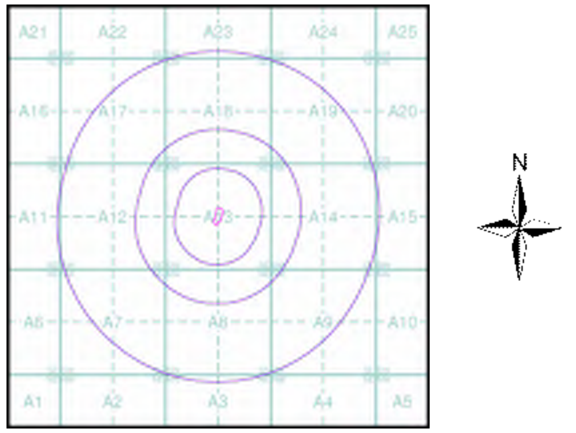
Modelled Flood Depth

Fluvial Depth	Coastal Depth
0.01m - 0.05m	0.01m - 0.05m
0.05m - 0.1m	0.05m - 0.1m
0.1m - 0.3m	0.1m - 0.3m
0.3m - 1m	0.3m - 1m
>1m	>1m

Contours (height in metres)

Standard Contour
Master Contour
Spot Height
MLW Mean Low Water
MHW Mean High Water

JBA 100 Year Return Flood Map (Undefended) - Slice A



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National Grid Reference:	555910, 363490
Slice:	A
Site Area (Ha):	0.4
Search Buffer (m):	1000

Site Details

Site at 555900, 363500

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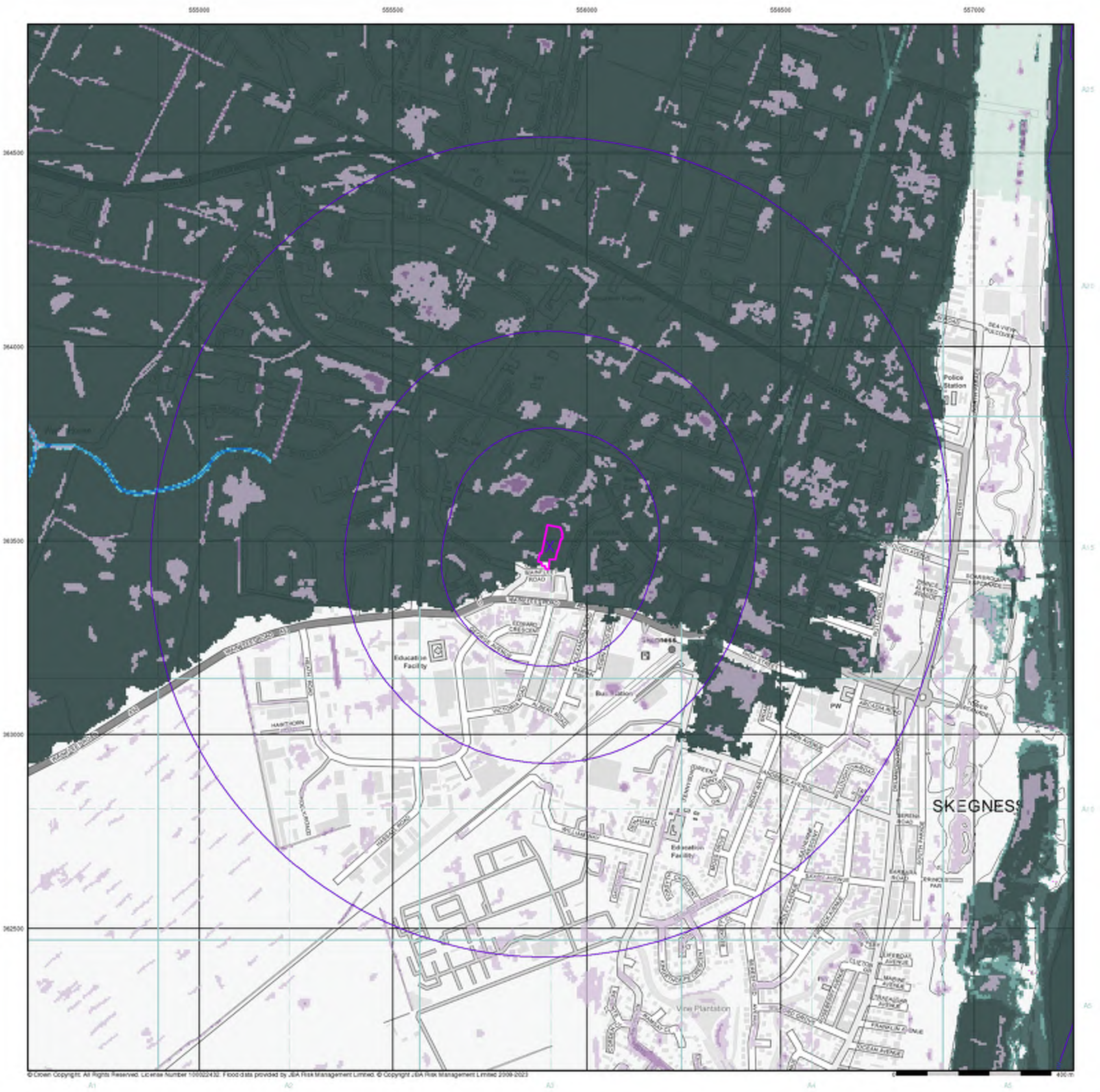

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JBA 200 Year Return Flood Map (Undefended) (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

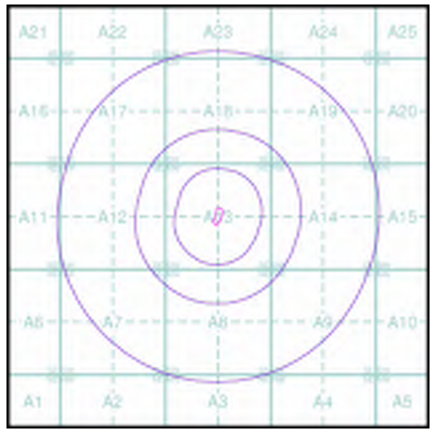
Modelled Flood Depth

Pluvial Depth		Fluvial Depth		Coastal Depth	
▨	0.1m	▨	0.01m - 0.05m	▨	0.01m - 0.05m
▨	0.1m - 0.3m	▨	0.05m - 0.1m	▨	0.05m - 0.1m
▨	0.3m - 1m	▨	0.1m - 0.3m	▨	0.1m - 0.3m
▨	>1m	▨	0.3m - 1m	▨	0.3m - 1m
		▨	>1m	▨	>1m

Contours (height in metres)

Standard Contour — 105
Master Contour — 100 — 95
Spot Height ·167.8
MLW Mean Low Water
MHW Mean High Water

JBA 200 Year Return Flood Map (Undefended) - Slice A



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Order Details

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Customer Ref:	950
National Grid Reference:	555910, 363490
Slice:	A
Site Area (Ha):	0.4
Search Buffer (m):	1000

Site Details

Site at 555900, 363500

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JBA 1000 Year Return Flood Map (Undefended) (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

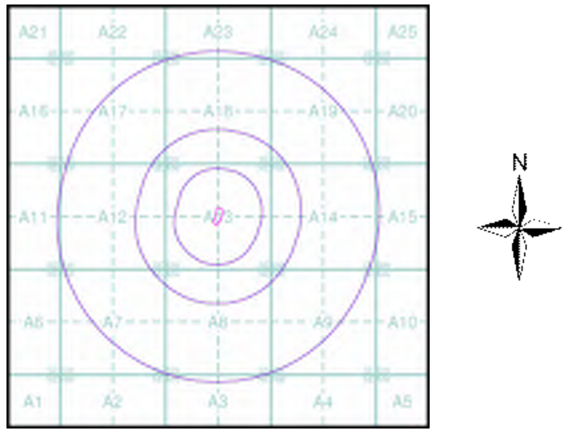
Modelled Flood Depth

Pluvial Depth	Fluvial Depth	Coastal Depth
0.1m	0.01m - 0.05m	0.01m - 0.05m
0.1m - 0.3m	0.05m - 0.1m	0.05m - 0.1m
0.3m - 1m	0.1m - 0.3m	0.1m - 0.3m
>1m	0.3m - 1m	0.3m - 1m
	>1m	>1m

Contours (height in metres)

Standard Contour
Master Contour
Spot Height
MLW Mean Low Water
MHW Mean High Water

JBA 1000 Year Return Flood Map (Undefended) - Slice A



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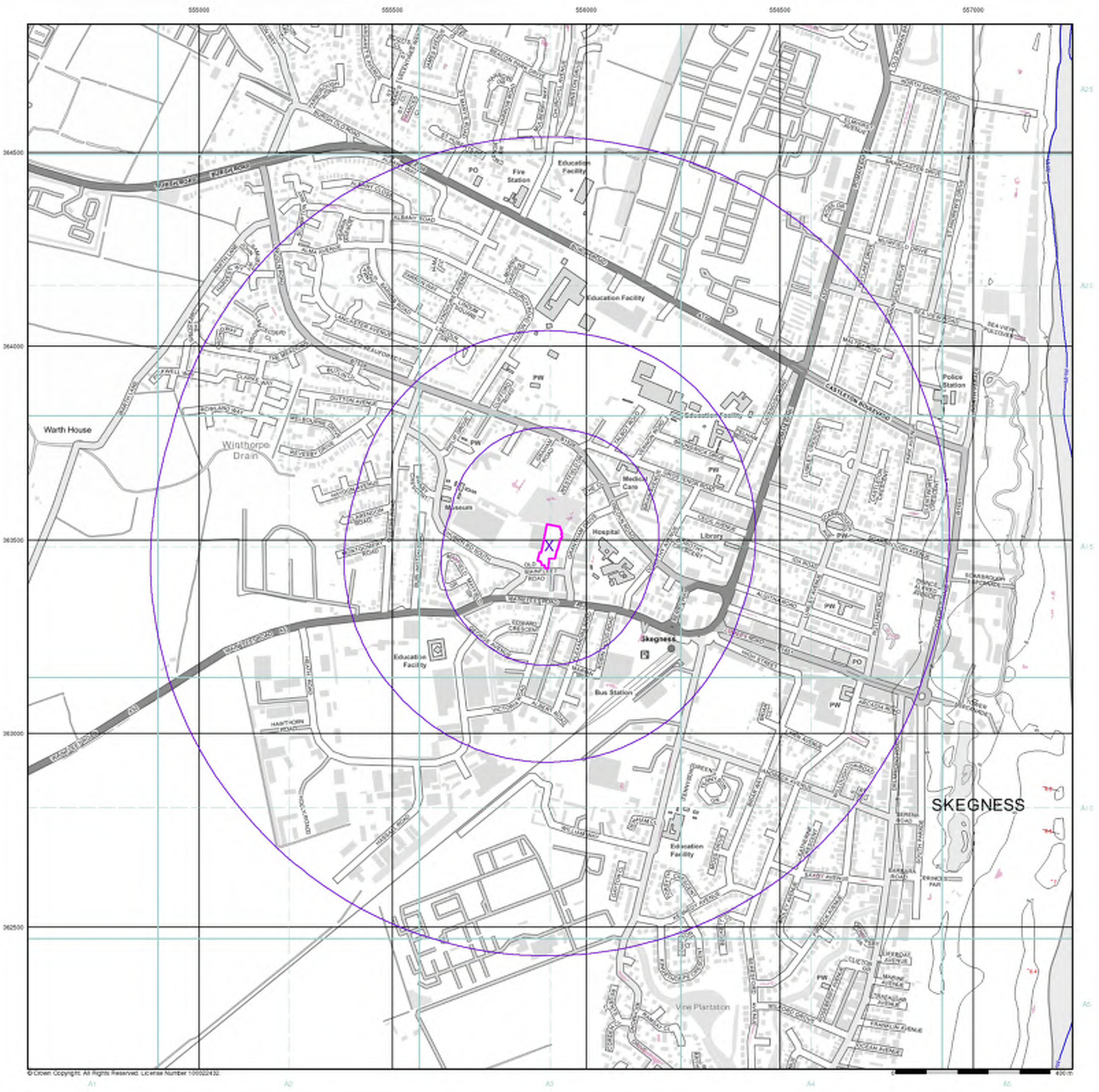

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EA/NRW Surface Water 30 Year Return Depth Map (1:10,000)

General

Specified Site   Specified Buffer(s)   X Bearing Reference Point

Surface Water Depth

■	0 - 0.15m
■	0.15 - 0.30m
■	0.30 - 0.60m
■	0.60 - 0.90m
■	0.90 - 1.20m
■	> 1.20m

Contours (height in metres)

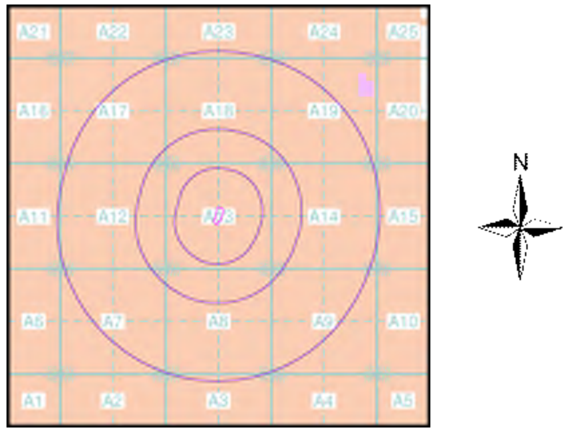
Standard Contour	105	MLW	Mean Low Water
Master Contour	100 95	MHW	Mean High Water
Spot Height	167.8		

Suitability

See the suitability map below

■	National to county	■	Street to parcels of land
■	County to town	■	Property
■	Town to street		

EA/NRW Suitability Map - Slice A



Order Details

Order Number:	313324259_1_1
Customer Ref:	950
National Grid Reference:	555910, 363490
Slice:	A
Site Area (Ha):	0.4
Search Buffer (m):	1000

Site Details

Site at 555900, 363500

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EA/NRW Surface Water 100 Year Return Depth Map

General

Specified Site
Specified Buffer(s)
X Bearing Reference Point

Surface Water Depth

▨	0 - 0.15m
▨	0.15 - 0.30m
▨	0.30 - 0.60m
▨	0.60 - 0.90m
▨	0.90 - 1.20m
▨	> 1.20m

Contours (height in metres)

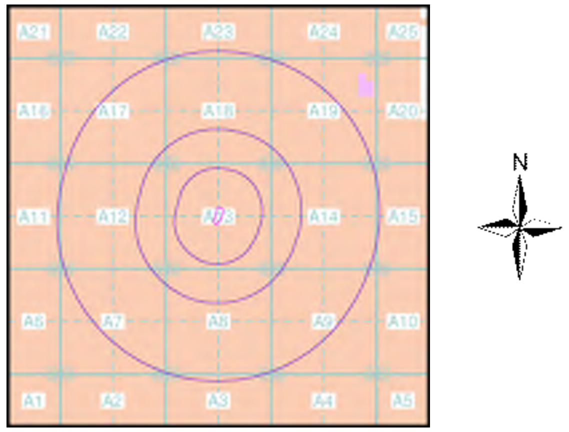
Standard Contour
Master Contour
Spot Height ·167.8
MLW Mean Low Water
MHW Mean High Water

Suitability

See the suitability map below

National to county	Street to parcels of land
County to town	Property
Town to street	

EA/NRW Suitability Map - Slice A



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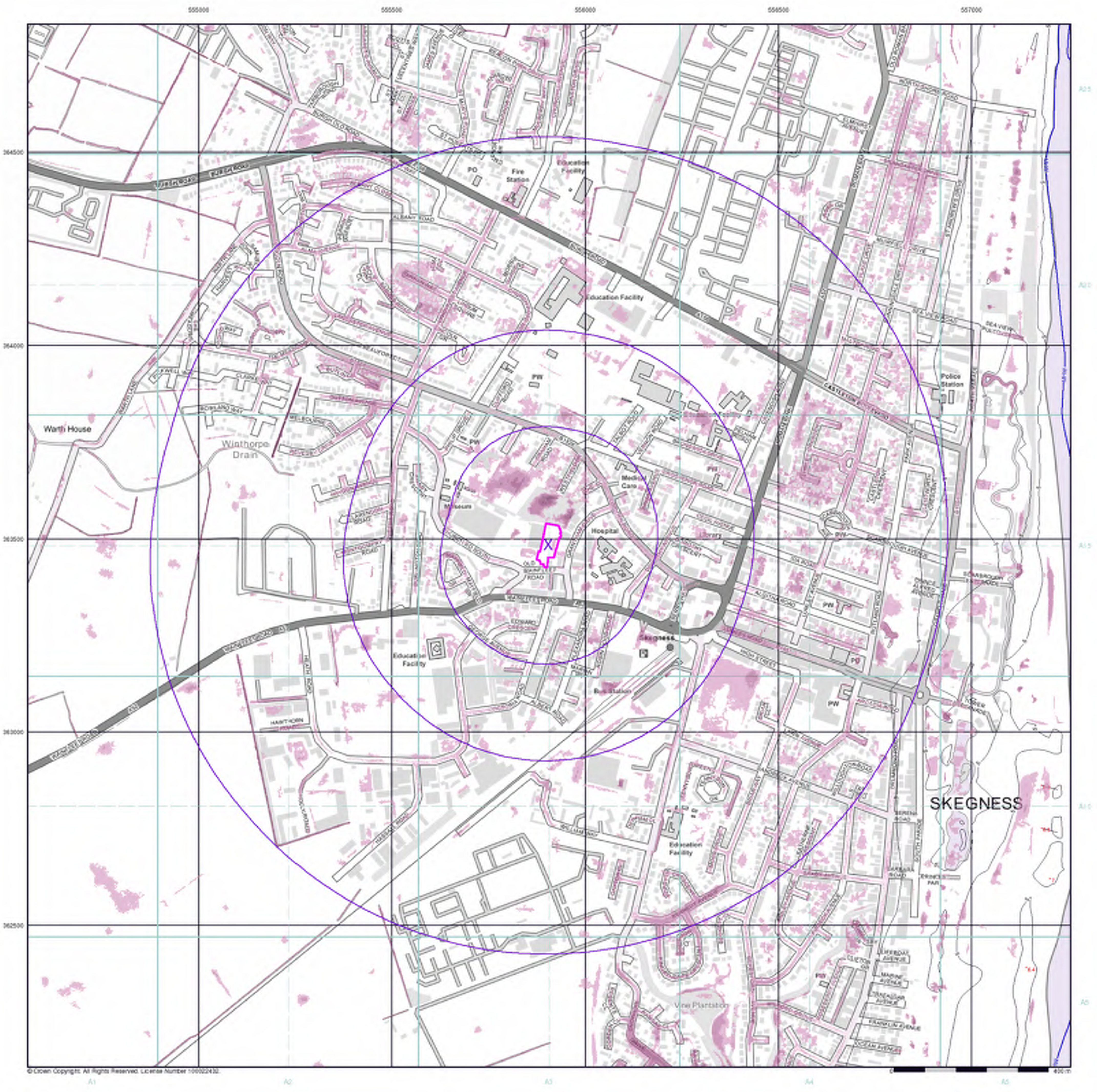

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EA/NRW Surface Water 1000 Year Return Depth Map (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

Surface Water Depth

- 0 - 0.15m
- 0.15 - 0.30m
- 0.30 - 0.60m
- 0.60 - 0.90m
- 0.90 - 1.20m
- > 1.20m

Contours (height in metres)

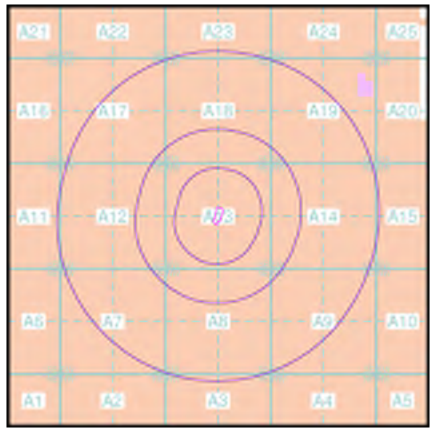
- Standard Contour
- Master Contour
- Spot Height
- MLW Mean Low Water
- MHW Mean High Water

Suitability

See the suitability map below

- National to county
- County to town
- Town to street
- Street to parcels of land
- Property

EA/NRW Suitability Map - Slice A



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National Grid Reference:	555910, 363490
Slice:	A
Site Area (Ha):	0.4
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Site at 555900, 363500

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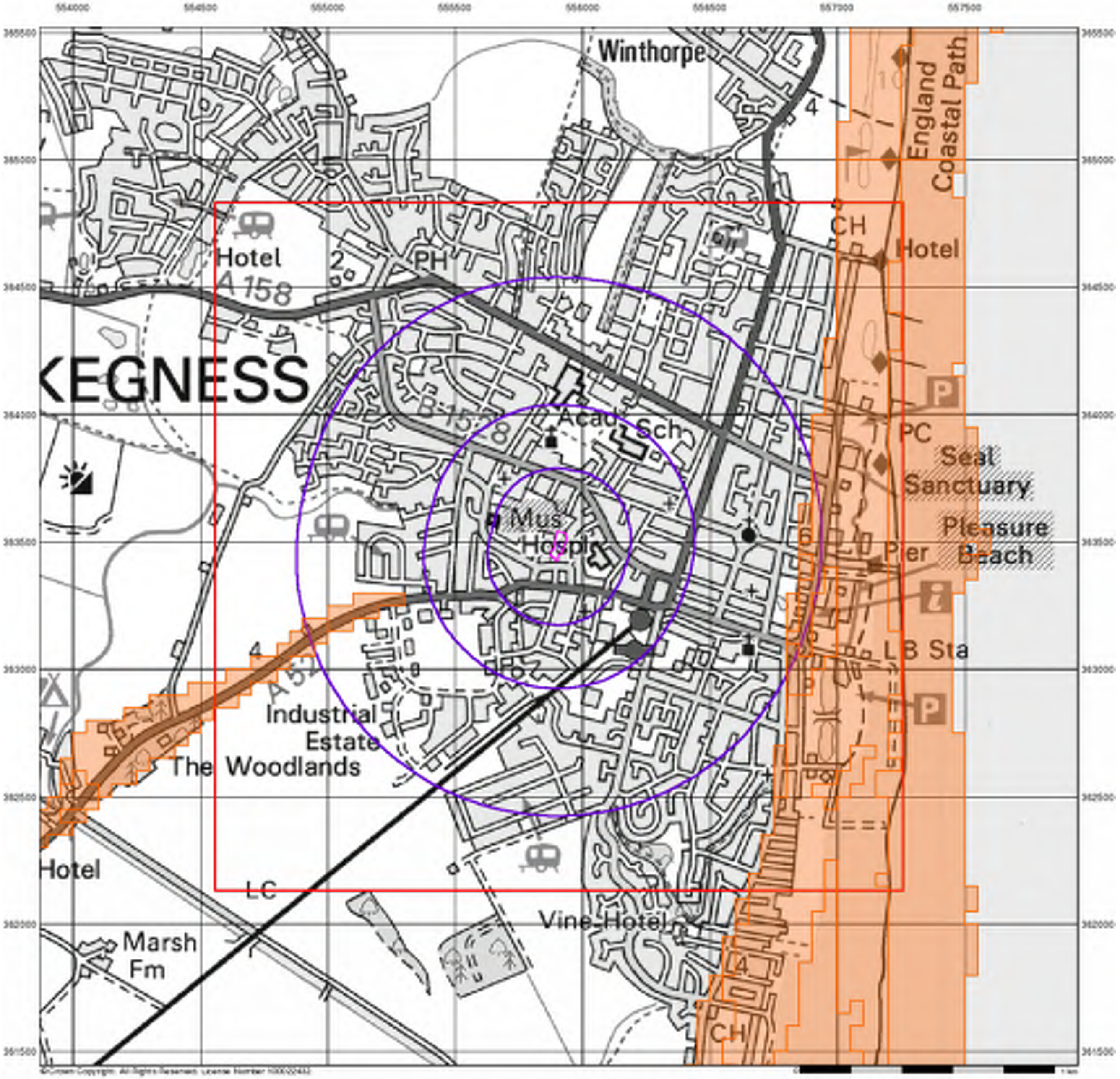

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BGS Flood Data (1:50,000)

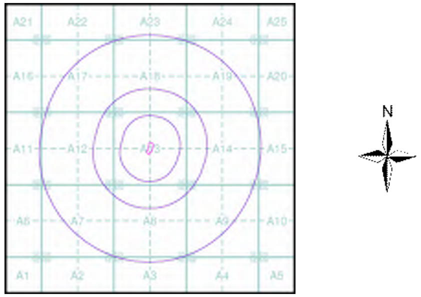
General

⬡	Specified Site	⬡	Specified Buffer(s)	X	Bearing Reference Point
☐	Slice	8	Map ID		

BGS Groundwater Flooding Susceptibility

🟦	Potential for Groundwater Flooding to Occur at Surface
🟦	Potential for Groundwater Flooding of Property Situated Below Ground Level
🟧	Limited Potential for Groundwater Flooding to Occur

BGS Flood Data Map - Slice A

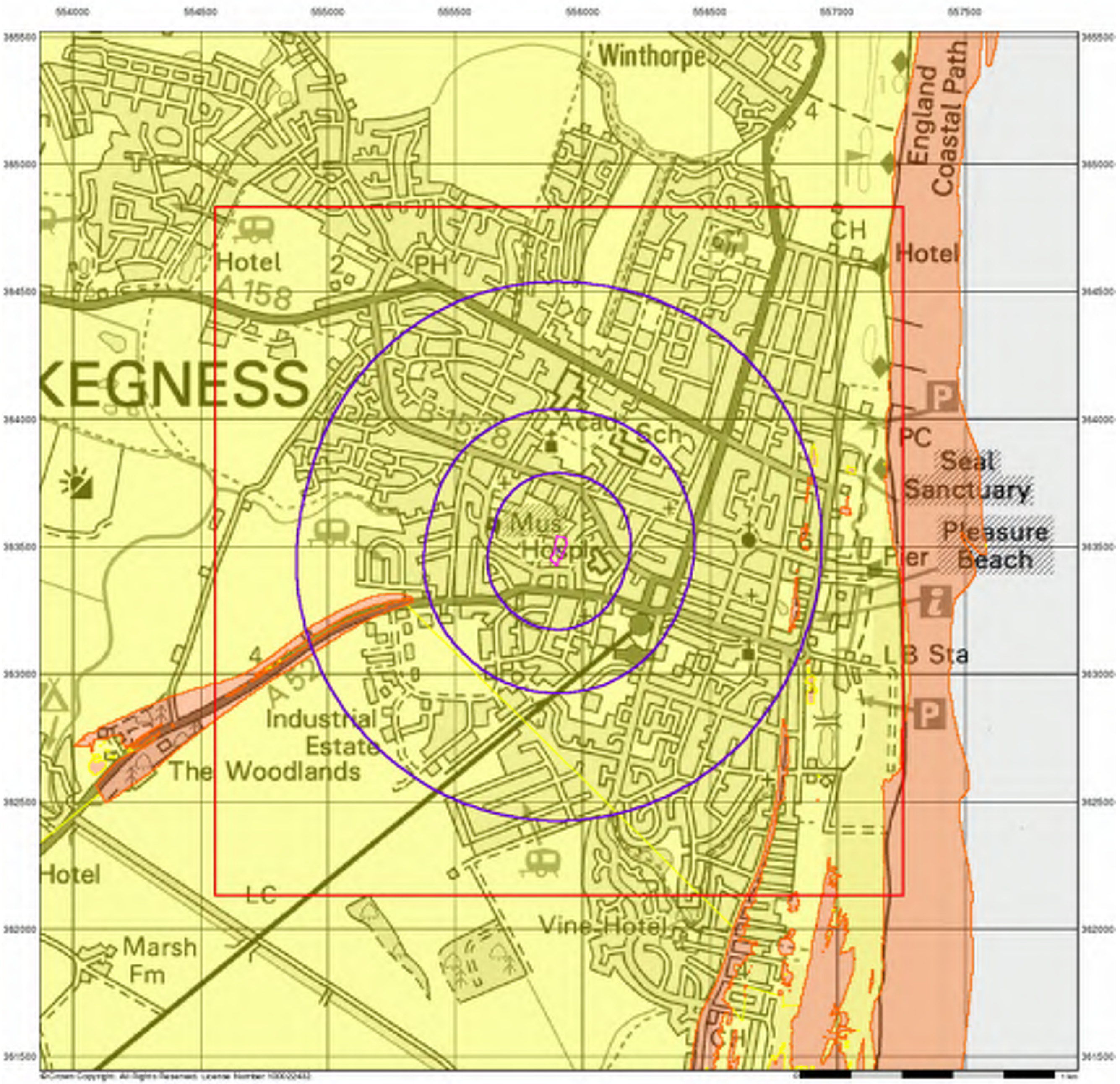


Order Details

Order Number:	313324259_1_1
Customer Ref:	950
National Grid Reference:	555910, 363490
Slice:	A
Site Area (Ha):	0.4
Search Buffer (m):	1000

Site Details

Site at 555900, 363500



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GeoSmart Information Groundwater Flood Map (1:50,000)

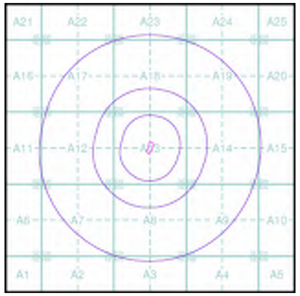
General

⬠	Specified Site
⬠	Specified Buffer(s)
X	Bearing Reference Point
☐	Slice

GeoSmart Information Groundwater Flooding Risk

🟦	High Risk
☐	Moderate Risk
🟧	Low Risk
🟨	Negligible Risk

GeoSmart Information Groundwater Flood Map - Slice A



N

Order Details

Order Number:	313324259_1_1
Customer Ref:	950
National Grid Reference:	555910, 363490
Slice:	A
Site Area (Ha):	0.4
Search Buffer (m):	1000

Site Details

Site at 555900, 363500

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JBA Canal Failure Map (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

Flood Data

- ■ Canal Failure
- ▨ Coverage

Contours (height in metres)

Standard Contour

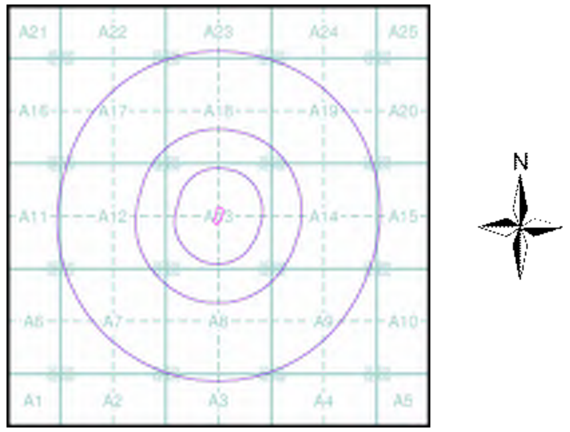
Master Contour

Spot Height

MLW Mean Low Water

MHW Mean High Water

JBA Canal Failure Flood Map - Slice A



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Site Area (Ha):	0.4
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EA/NRW Historic Flood Map (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point
- Map ID

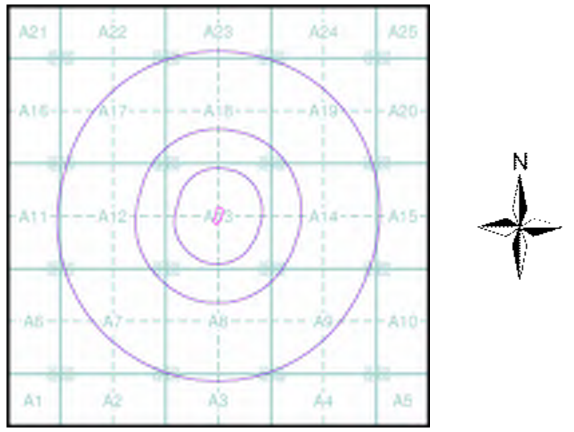
Historic Flood Events Data

- 🟦 Channel Capacity Exceeded (no raised defences)
- ▤ Channel Capacity Exceeded /Surface Water
- 🟧 Groundwater/High Water Table
- ▩ Local Drainage/Surface Water
- 🟩 Mechanical Failure
- ▥ Obstruction/Blockage - Bridge
- ▨ Obstruction/Blockage - Channel
- ● Historical Flood Liabilities
- ▨ Obstruction/Blockage - Culvert
- ▨ Obstruction/Blockage - Debris Screen
- ▨ Operational Failure/ Breach of Defence
- ▨ Other
- ▤ Overtopping of Defences
- ▤ Surface Water
- ▨ Unknown

Contours (height in metres)

- Standard Contour
- Master Contour
- Spot Height
- MLW Mean Low Water
- MHW Mean High Water

EA/NRW Historic Flood Map - Slice A



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Appendix H Greenfield Run-Off Rates and Volume Calculations

IH 124 Mean Annual Flood

```
                                 Input

Return Period (years)      2 SAAR (mm)   609        Urban     0.750
            Area (ha) 50.000       Soil 0.400 Region Number Region 5

                            Results     l/s

                          QBAR Rural  144.5
                          QBAR Urban  442.2

                            Q2 years  453.4

                             Q1 year  384.7
                            Q2 years  453.4
                            Q5 years  601.0
                           Q10 years  681.7
                           Q20 years  755.8
                           Q25 years  774.9
                           Q30 years  790.0
                           Q50 years  839.7
                          Q100 years  939.1
                          Q200 years 1004.3
                          Q250 years 1022.9
                         Q1000 years 1156.8
```

Greenfield Runoff Volume

FEH Data

Return Period (years)	100
Storm Duration (mins)	360
FEH Rainfall Version	2013
Site Location	GB 555900 363500 TF 55900 63500
Data Type	Point
Areal Reduction Factor	1.00
Area (ha)	0.388
SAAR (mm)	612
CWI	89.160
SPR Host	47.000
URBEXT (USER)	0.5000

Results

Percentage Runoff (%)	51.65
Greenfield Runoff Volume (m³)	150.958

Appendix I Pre-Development Run-Off Rates and Volume Calcs

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 555900 363500 TF 55900 63500
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Additional Flow - % of Total Flow	40.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	120
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	2

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

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 525950 182150 TQ 25950 82150
C (1km)	-0.025
D1 (1km)	0.344
D2 (1km)	0.239
D3 (1km)	0.226
E (1km)	0.326

Synthetic Rainfall Details

F (1km)	2.552
Summer Storms	No
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	60

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	40.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

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

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 555900 363500 TF 55900 63500
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 0

PN	**US/MH Name**	**Storm**	**Return Period**	**Climate Change**	**First (X) Surcharge**	**First (Y) Flood**	**First (Z) Overflow**	**Overflow Act.**	**Water Level (m)**
1.000	1	15 Winter	2	+0%	30/15 Summer				1.129
1.001	2	15 Winter	2	+0%	30/15 Summer				0.650

PN	**US/MH Name**	**Surcharged Depth (m)**	**Flooded Volume (m³)**	**Flow / Cap.**	**Overflow (l/s)**	**Half Drain Time (mins)**	**Pipe Flow (l/s)**	**Status**	**Level Exceeded**
1.000	1	-0.171	0.000	0.38			67.3	OK	
1.001	2	-0.150	0.000	0.48			85.7	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	40.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

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

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 555900 363500 TF 55900 63500
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 0

PN	**US/MH Name**	**Storm**	**Return Period**	**Climate Change**	**First (X) Surcharge**	**First (Y) Flood**	**First (Z) Overflow**	**Overflow Act.**	**Water Level (m)**
1.000	1	15 Winter	30	+0%	30/15 Summer				1.464
1.001	2	15 Winter	30	+0%	30/15 Summer				1.047

PN	**US/MH Name**	**Surcharged Depth (m)**	**Flooded Volume (m^3)**	**Flow / Cap.**	**Overflow (l/s)**	**Half Drain Time (mins)**	**Pipe Flow (l/s)**	**Status**	**Level Exceeded**
1.000	1	0.164	0.000	0.92			162.7	SURCHARGED	
1.001	2	0.247	0.000	1.22			216.4	SURCHARGED	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

```
            Areal Reduction Factor 1.000   Additional Flow - % of Total Flow 40.000
                  Hot Start (mins)     0       MADD Factor * 10m³/ha Storage  2.000
                Hot Start Level (mm)     0                 Inlet Coeffiecient  0.800
     Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day)  0.000
         Foul Sewage per hectare (l/s) 0.000

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

Synthetic Rainfall Details

```
          Rainfall Model                         FEH
     FEH Rainfall Version                        2013
            Site Location GB 555900 363500 TF 55900 63500
                Data Type                        Point
              Cv (Summer)                        0.750
              Cv (Winter)                        0.840

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

              Profile(s)                         Summer and Winter
       Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
     Return Period(s) (years)                               2, 30, 100
        Climate Change (%)                                     0, 0, 0
```

PN	**US/MH Name**	**Storm**	**Return Period**	**Climate Change**	**First (X) Surcharge**	**First (Y) Flood**	**First (Z) Overflow**	**Overflow Act.**	**Water Level (m)**
1.000	1	15 Winter	100	+0%	30/15 Summer				2.140
1.001	2	15 Winter	100	+0%	30/15 Summer				1.468

PN	**US/MH Name**	**Surcharged Depth (m)**	**Flooded Volume (m^3)**	**Flow / Cap.**	**Overflow (l/s)**	**Half Drain Time (mins)**	**Pipe Flow (l/s)**	**Status**	**Level Exceeded**
1.000	1	0.840	0.000	1.15			203.2	SURCHARGED	
1.001	2	0.668	0.000	1.52			270.0	SURCHARGED	

Simulation Criteria for Storm

```
      Volumetric Runoff Coeff 0.840   Additional Flow - % of Total Flow 40.000
       Areal Reduction Factor 1.000       MADD Factor * 10m³/ha Storage  2.000
             Hot Start (mins)     0                  Inlet Coeffiecient  0.800
           Hot Start Level (mm)   0  Flow per Person per Day (l/per/day)  0.000
 Manhoe Headloss Coeff (Global) 0.500                     Run Time (mins)   120
    Foul Sewage per hectare (l/s) 0.000             Output Interval (mins)     2

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

Synthetic Rainfall Details

```
              Rainfall Model                               FEH
       Return Period (years)                               100
         FEH Rainfall Version                              1999
               Site Location GB 525950 182150 TQ 25950 82150
                    C (1km)                             -0.025
                   D1 (1km)                              0.344
                   D2 (1km)                              0.239
                   D3 (1km)                              0.226
                    E (1km)                              0.326
                    F (1km)                              2.552
              Summer Storms                                 No
              Winter Storms                                Yes
                Cv (Summer)                              0.750
                Cv (Winter)                              0.840
       Storm Duration (mins)                                60
```

Summary Wizard of 360 minute 100 year Winter I+0% for Storm

Simulation Criteria

```
            Areal Reduction Factor 1.000   Additional Flow - % of Total Flow 40.000
                  Hot Start (mins)     0       MADD Factor * 10m³/ha Storage  2.000
              Hot Start Level (mm)     0                   Inlet Coeffiecient  0.800
    Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day)  0.000
        Foul Sewage per hectare (l/s) 0.000

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

Synthetic Rainfall Details

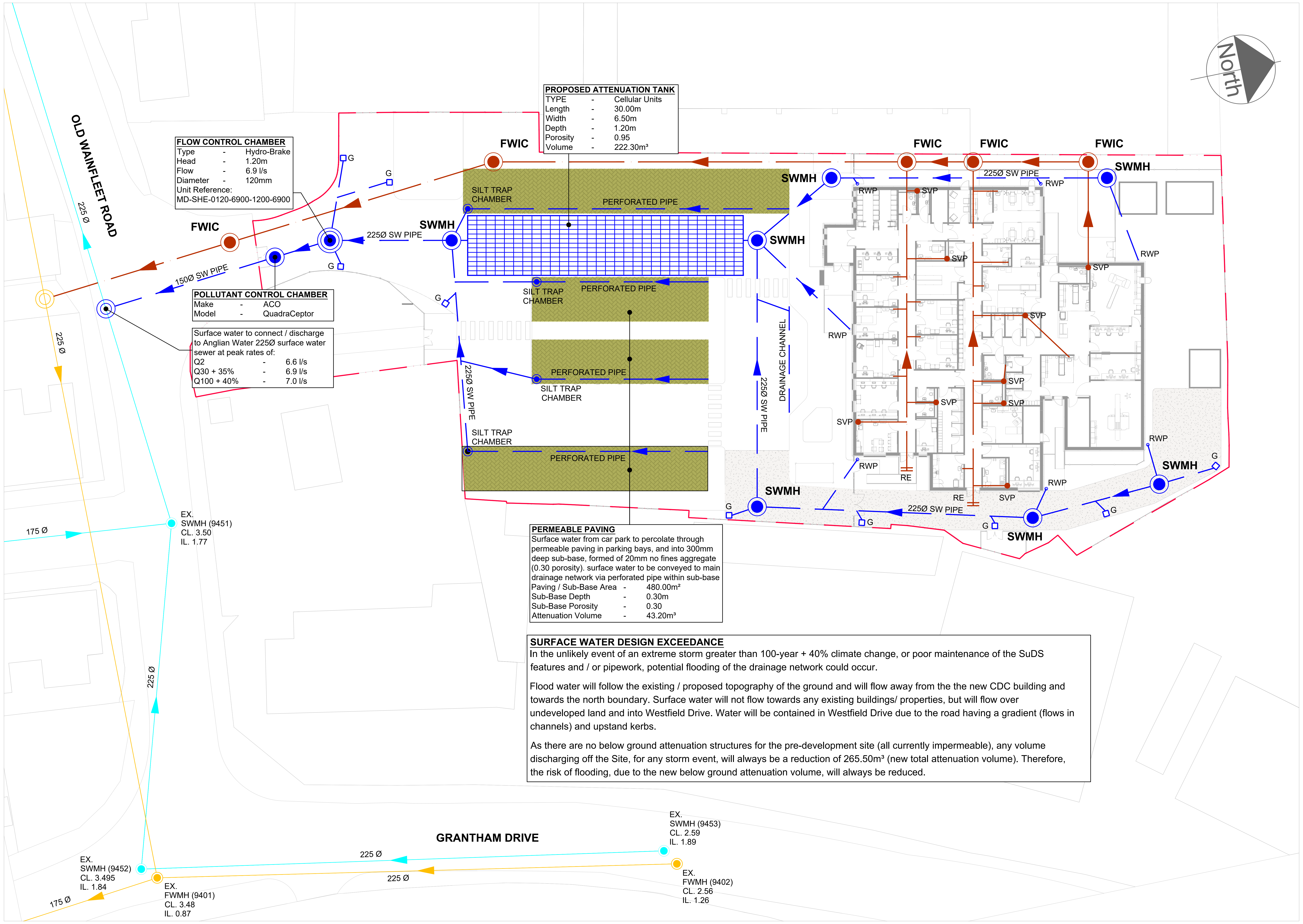
```
           Rainfall Model                             FEH
      FEH Rainfall Version                           2013
             Site Location GB 555900 363500 TF 55900 63500
                 Data Type                          Point
                Cv (Summer)                         0.750
                Cv (Winter)                         0.840

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


           Profile(s)                               Summer and Winter
      Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
   Return Period(s) (years)                                2, 30, 100
      Climate Change (%)                                     0, 0, 0
```

```
                                                Water  Surcharged Flooded
       US/MH                              US/CL Level    Depth     Volume  Flow / Overflow
  PN   Name            Event               (m)   (m)      (m)       (m³)    Cap.    (l/s)

1.000     1 360 minute 100 year Winter I+0% 2.500 1.083     -0.217    0.000    0.17
1.001     2 360 minute 100 year Winter I+0% 2.500 0.597     -0.203    0.000    0.23
```

```
                     Pipe
        US/MH Discharge Flow
   PN    Name  Vol (m³) (l/s) Status

1.000       1   262.242  30.5    OK
1.001       2   351.091  40.8    OK
```

Appendix J Surface Water Management Layout and Details

TO BE PRINTED IN COLOUR



FLOW CONTROL CHAMBER

Type	-	Hydro-Brake
Head	-	1.20m
Flow	-	6.9 l/s
Diameter	-	120mm

Unit Reference:
MD-SHE-0120-6900-1200-6900

PROPOSED ATTENUATION TANK

TYPE	-	Cellular Units
Length	-	30.00m
Width	-	6.50m
Depth	-	1.20m
Porosity	-	0.95
Volume	-	222.30m³

POLLUTANT CONTROL CHAMBER

Make	-	ACO
Model	-	QuadraCeptor

Surface water to connect / discharge to Anglian Water 225Ø surface water sewer at peak rates of:

Q2	-	6.6 l/s
Q30 + 35%	-	6.9 l/s
Q100 + 40%	-	7.0 l/s

PERMEABLE PAVING

Surface water from car park to percolate through permeable paving in parking bays, and into 300mm deep sub-base, formed of 20mm no fines aggregate (0.30 porosity). surface water to be conveyed to main drainage network via perforated pipe within sub-base

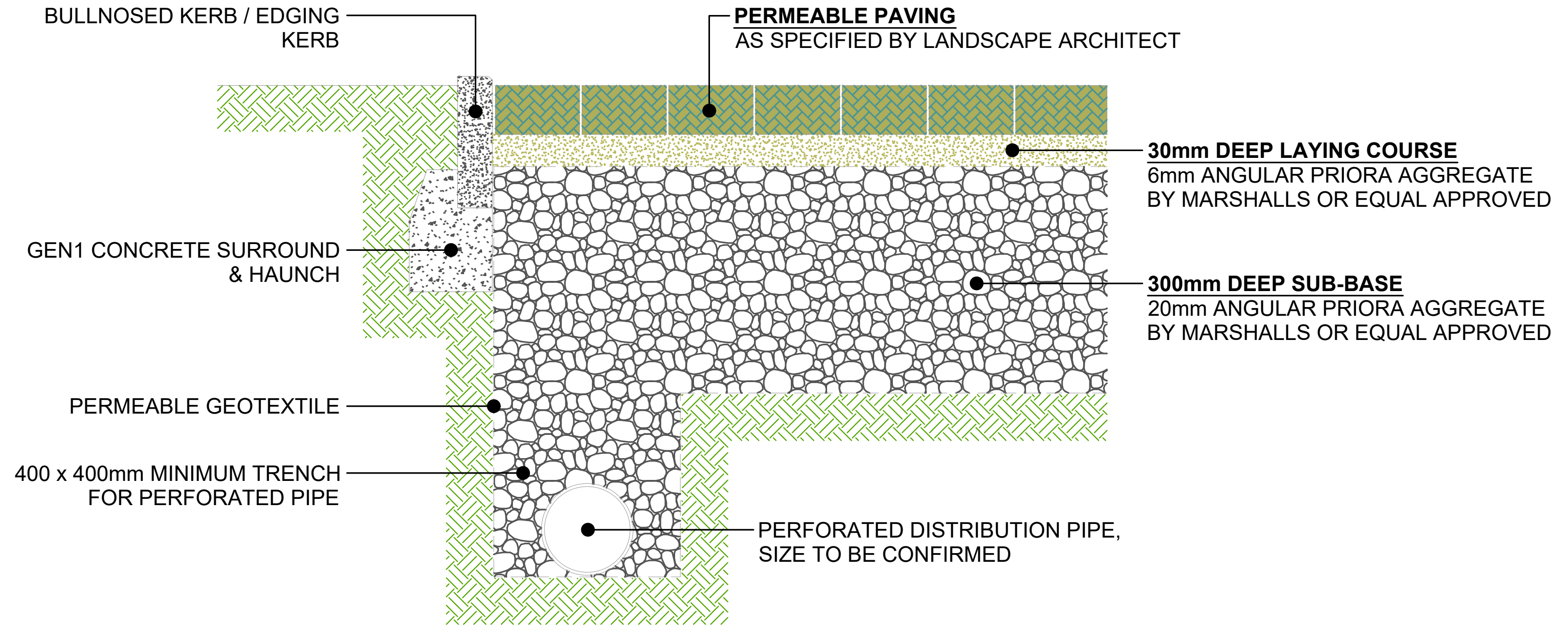
Paving / Sub-Base Area	-	480.00m²
Sub-Base Depth	-	0.30m
Sub-Base Porosity	-	0.30
Attenuation Volume	-	43.20m³

SURFACE WATER DESIGN EXCEEDANCE

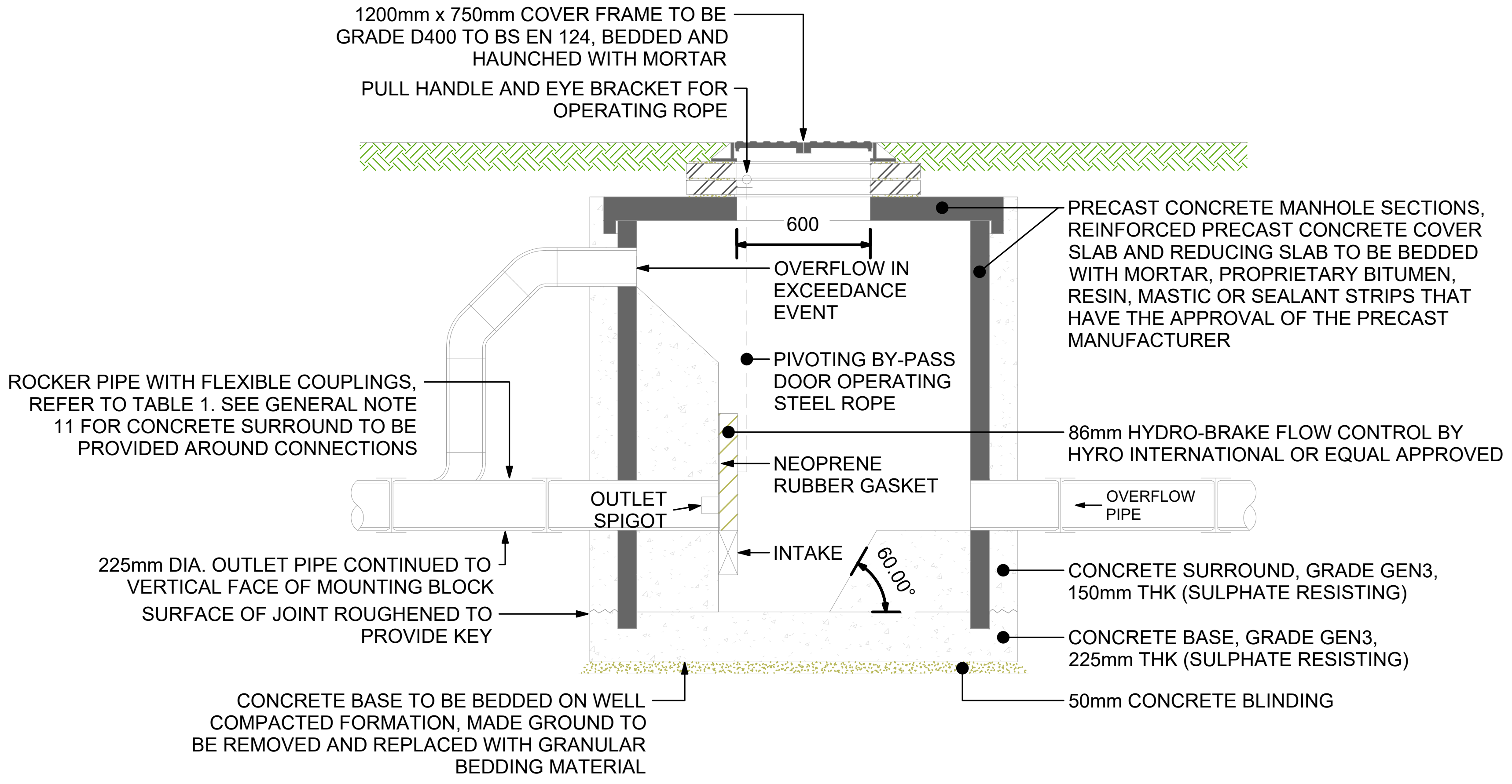
In the unlikely event of an extreme storm greater than 100-year + 40% climate change, or poor maintenance of the SuDS features and / or pipework, potential flooding of the drainage network could occur.

Flood water will follow the existing / proposed topography of the ground and will flow away from the the new CDC building and towards the north boundary. Surface water will not flow towards any existing buildings/ properties, but will flow over undeveloped land and into Westfield Drive. Water will be contained in Westfield Drive due to the road having a gradient (flows in channels) and upstand kerbs.

As there are no below ground attenuation structures for the pre-development site (all currently impermeable), any volume discharging off the Site, for any storm event, will always be a reduction of 265.50m³ (new total attenuation volume). Therefore, the risk of flooding, due to the new below ground attenuation volume, will always be reduced.



PERMEABLE SURFACING DRAINAGE DETAIL



FLOW CONTROL CHAMBER DETAIL

A1

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.

LEGEND :

🟥	DEVELOPMENT BOUNDARY
🟨	EXISTING FOUL WATER SEWER
🟦	EXISTING SURFACE WATER SEWER
🟥	PROPOSED FOUL WATER DRAINAGE
🟦	PROPOSED SURFACE WATER DRAINAGE
RE	PROPOSED RODDING EYE
☐ G	PROPOSED ROAD GULLEY c/w SILT BASKET
○ RWP	PROPOSED RAINWATER PIPE
● SVP	PROPOSED SOIL & VENT PIPE

NOTE :
THE PROPOSED DRAINAGE LAYOUT INDICATED ON THIS DRAWING IS **INDICATIVE ONLY** AND IS SUBJECT TO CHANGE FOLLOWING FURTHER SITE INVESTIGATIONS, UTILITIES SURVEYS AND DRAINAGE SURFACE WATER MANAGEMENT REPORT.

NOTE :
THE EXISTING FOUL & SURFACE WATER DRAINAGE POSITIONS SHOWN ON THIS DRAWING ARE APPROXIMATE, TAKEN FROM ANGLIAN WATER DRAWING No. 1154942-2 WASTEWATER PLAN A3. LOCATIONS TO BE CONFIRMED FOLLOWING A DETAILED CCTV DRAINAGE REPORT

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

PRELIMINARY DRAWING ISSUE

P.02	PRELIMINARY WIP DRAWING ISSUE	27.06.23	MS
P.01	PRELIMINARY WIP DRAWING ISSUE	09.06.23	SR
Rev	Description	Date	Drawn

NHS
United Lincolnshire Hospitals
NHS Trust

Appointed Party Logo / Information :

ccs consulting
MANCHESTER LONDON LEEDS

Project :
SKEGNESS CDC

Title :
PROPOSED BELOW GROUND DRAINAGE LAYOUT

Status :	Purpose of Issue :	
S0	WORK IN PROGRESS	
Drawn By :	Checked By :	Date :
SR	YA	JUNE '23
Scale @ A1 :	CCS Project Number :	
1:250 As indicated 1:25	23-2425	
Project Number | Originator | Volume | Level | Type | Role | Sheet Number :	Rev :	
232425-CCS-CDC-XX-DR-S-0200	**P.02**	

21/06/2023 13:11:45

Appendix K Surface Water Management Calculations

Summary of Results for 2 year Return Period

Half Drain Time : 64 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	0.917	0.117	0.0	5.1	5.1	21.7	O K
30 min Summer	0.943	0.143	0.0	6.0	6.0	26.5	O K
60 min Summer	0.962	0.162	0.0	6.2	6.2	30.0	O K
120 min Summer	0.996	0.196	0.0	6.5	6.5	36.2	O K
180 min Summer	1.004	0.204	0.0	6.5	6.5	37.8	O K
240 min Summer	1.003	0.203	0.0	6.5	6.5	37.5	O K
360 min Summer	0.988	0.188	0.0	6.4	6.4	34.8	O K
480 min Summer	0.969	0.169	0.0	6.3	6.3	31.3	O K
600 min Summer	0.953	0.153	0.0	6.1	6.1	28.3	O K
720 min Summer	0.939	0.139	0.0	6.0	6.0	25.8	O K
960 min Summer	0.921	0.121	0.0	5.3	5.3	22.5	O K
1440 min Summer	0.899	0.099	0.0	4.2	4.2	18.4	O K
2160 min Summer	0.883	0.083	0.0	3.2	3.2	15.3	O K
2880 min Summer	0.873	0.073	0.0	2.6	2.6	13.5	O K
4320 min Summer	0.862	0.062	0.0	2.0	2.0	11.5	O K
5760 min Summer	0.855	0.055	0.0	1.6	1.6	10.3	O K
7200 min Summer	0.851	0.051	0.0	1.4	1.4	9.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Discharge Volume (m^3)	Time-Peak (mins)
15 min Summer	36.372	0.0	25.6	33
30 min Summer	23.338	0.0	33.1	42
60 min Summer	14.444	0.0	41.5	60
120 min Summer	9.989	0.0	57.6	96
180 min Summer	7.768	0.0	67.2	130
240 min Summer	6.403	0.0	73.9	162
360 min Summer	4.775	0.0	82.7	228
480 min Summer	3.829	0.0	88.5	290
600 min Summer	3.210	0.0	92.7	348
720 min Summer	2.772	0.0	96.1	406
960 min Summer	2.191	0.0	101.2	526
1440 min Summer	1.568	0.0	108.6	766
2160 min Summer	1.127	0.0	117.3	1124
2880 min Summer	0.896	0.0	124.4	1488
4320 min Summer	0.659	0.0	136.8	2216
5760 min Summer	0.536	0.0	148.8	2944
7200 min Summer	0.461	0.0	159.8	3672

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
8640 min Summer	0.848	0.048	0.0	1.3	1.3	8.9	O K
10080 min Summer	0.846	0.046	0.0	1.2	1.2	8.5	O K
15 min Winter	0.931	0.131	0.0	5.7	5.7	24.2	O K
30 min Winter	0.960	0.160	0.0	6.2	6.2	29.7	O K
60 min Winter	0.982	0.182	0.0	6.4	6.4	33.8	O K
120 min Winter	1.017	0.217	0.0	6.6	6.6	40.2	O K
180 min Winter	1.022	0.222	0.0	6.6	6.6	41.0	O K
240 min Winter	1.014	0.214	0.0	6.6	6.6	39.7	O K
360 min Winter	0.987	0.187	0.0	6.4	6.4	34.7	O K
480 min Winter	0.960	0.160	0.0	6.2	6.2	29.6	O K
600 min Winter	0.939	0.139	0.0	6.0	6.0	25.7	O K
720 min Winter	0.925	0.125	0.0	5.4	5.4	23.2	O K
960 min Winter	0.906	0.106	0.0	4.6	4.6	19.7	O K
1440 min Winter	0.886	0.086	0.0	3.4	3.4	15.9	O K
2160 min Winter	0.871	0.071	0.0	2.5	2.5	13.1	O K
2880 min Winter	0.862	0.062	0.0	2.0	2.0	11.5	O K
4320 min Winter	0.852	0.052	0.0	1.5	1.5	9.7	O K
5760 min Winter	0.847	0.047	0.0	1.2	1.2	8.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Discharge Volume (m^3)	Time-Peak (mins)
8640 min Summer	0.410	0.0	170.5	4408
10080 min Summer	0.373	0.0	180.8	5144
15 min Winter	36.372	0.0	28.8	33
30 min Winter	23.338	0.0	37.1	43
60 min Winter	14.444	0.0	46.5	64
120 min Winter	9.989	0.0	64.5	102
180 min Winter	7.768	0.0	75.4	138
240 min Winter	6.403	0.0	82.9	174
360 min Winter	4.775	0.0	92.7	240
480 min Winter	3.829	0.0	99.2	302
600 min Winter	3.210	0.0	104.0	358
720 min Winter	2.772	0.0	107.7	418
960 min Winter	2.191	0.0	113.5	536
1440 min Winter	1.568	0.0	121.7	778
2160 min Winter	1.127	0.0	131.5	1132
2880 min Winter	0.896	0.0	139.4	1492
4320 min Winter	0.659	0.0	153.4	2220
5760 min Winter	0.536	0.0	166.8	2944

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
7200 min Winter	0.843	0.043	0.0	1.1	1.1	8.0	O K
8640 min Winter	0.841	0.041	0.0	0.9	0.9	7.5	O K
10080 min Winter	0.839	0.039	0.0	0.9	0.9	7.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
7200 min Winter	0.461	0.0	179.2	3648
8640 min Winter	0.410	0.0	191.1	4408
10080 min Winter	0.373	0.0	202.7	5112

Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 555900 363500 TF 55900 63500
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) 0.388

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.065	8	12	0.065	16	20	0.064
4	8	0.065	12	16	0.065	20	24	0.064

Model Details

Storage is Online Cover Level (m) 2.500

Complex Structure

Cellular Storage

Invert Level (m)	0.800	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	**Area (m²)**	**Inf. Area (m²)**	**Depth (m)**	**Area (m²)**	**Inf. Area (m²)**
0.000	195.0	0.0	2.600	0.0	0.0
0.200	195.0	0.0	2.800	0.0	0.0
0.400	195.0	0.0	3.000	0.0	0.0
0.600	195.0	0.0	3.200	0.0	0.0
0.800	195.0	0.0	3.400	0.0	0.0
1.000	195.0	0.0	3.600	0.0	0.0
1.200	195.0	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

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	4.8
Membrane Percolation (mm/hr)	1000	Length (m)	10.0
Max Percolation (l/s)	13.3	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	1.500	Cap Volume Depth (m)	0.350

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0120-6900-1200-6900
Design Head (m)	1.200
Design Flow (l/s)	6.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes

Hydro-Brake® Optimum Outflow Control

Diameter (mm)	120
Invert Level (m)	0.800
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	6.9	Kick-Flo®	0.760	5.6
Flush-Flo™	0.356	6.9	Mean Flow over Head Range	-	6.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.2	1.200	6.9	3.000	10.6	7.000	15.9
0.200	6.5	1.400	7.4	3.500	11.4	7.500	16.4
0.300	6.9	1.600	7.9	4.000	12.2	8.000	16.9
0.400	6.9	1.800	8.3	4.500	12.9	8.500	17.4
0.500	6.8	2.000	8.8	5.000	13.5	9.000	17.9
0.600	6.5	2.200	9.2	5.500	14.2	9.500	18.4
0.800	5.7	2.400	9.5	6.000	14.8		
1.000	6.3	2.600	9.9	6.500	15.3		

Summary of Results for 30 year Return Period (+35%)

Half Drain Time : 211 minutes.

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
15 min Summer	1.223	0.423	0.0	6.9	6.9	78.4	O K
30 min Summer	1.352	0.552	0.0	6.9	6.9	102.2	O K
60 min Summer	1.466	0.666	0.0	6.9	6.9	123.3	O K
120 min Summer	1.549	0.749	0.0	6.9	6.9	139.5	O K
180 min Summer	1.569	0.769	0.0	6.9	6.9	143.4	O K
240 min Summer	1.560	0.760	0.0	6.9	6.9	141.7	O K
360 min Summer	1.520	0.720	0.0	6.9	6.9	133.8	O K
480 min Summer	1.473	0.673	0.0	6.9	6.9	124.7	O K
600 min Summer	1.424	0.624	0.0	6.9	6.9	115.6	O K
720 min Summer	1.376	0.576	0.0	6.9	6.9	106.7	O K
960 min Summer	1.287	0.487	0.0	6.9	6.9	90.3	O K
1440 min Summer	1.147	0.347	0.0	6.9	6.9	64.2	O K
2160 min Summer	1.017	0.217	0.0	6.6	6.6	40.3	O K
2880 min Summer	0.953	0.153	0.0	6.2	6.2	28.3	O K
4320 min Summer	0.912	0.112	0.0	4.8	4.8	20.7	O K
5760 min Summer	0.894	0.094	0.0	3.9	3.9	17.4	O K
7200 min Summer	0.884	0.084	0.0	3.3	3.3	15.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	122.109	0.0	87.9	35
30 min Summer	79.770	0.0	115.1	47
60 min Summer	49.608	0.0	143.8	74
120 min Summer	30.192	0.0	175.1	128
180 min Summer	22.353	0.0	194.5	182
240 min Summer	17.949	0.0	208.3	222
360 min Summer	13.030	0.0	226.8	276
480 min Summer	10.320	0.0	239.6	340
600 min Summer	8.584	0.0	249.1	404
720 min Summer	7.370	0.0	256.6	470
960 min Summer	5.771	0.0	267.9	598
1440 min Summer	4.077	0.0	283.8	840
2160 min Summer	2.870	0.0	300.0	1180
2880 min Summer	2.241	0.0	312.2	1512
4320 min Summer	1.591	0.0	332.0	2216
5760 min Summer	1.256	0.0	349.8	2944
7200 min Summer	1.052	0.0	366.3	3672

Summary of Results for 30 year Return Period (+35%)

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	0.877	0.077	0.0	2.9	2.9	14.2	O K
10080 min Summer	0.872	0.072	0.0	2.6	2.6	13.3	O K
15 min Winter	1.279	0.479	0.0	6.9	6.9	88.8	O K
30 min Winter	1.426	0.626	0.0	6.9	6.9	115.9	O K
60 min Winter	1.556	0.756	0.0	6.9	6.9	140.8	O K
120 min Winter	1.652	0.852	0.0	6.9	6.9	160.1	O K
180 min Winter	1.678	0.878	0.0	6.9	6.9	165.3	O K
240 min Winter	1.673	0.873	0.0	6.9	6.9	164.2	O K
360 min Winter	1.626	0.826	0.0	6.9	6.9	154.9	O K
480 min Winter	1.568	0.768	0.0	6.9	6.9	143.3	O K
600 min Winter	1.496	0.696	0.0	6.9	6.9	129.0	O K
720 min Winter	1.422	0.622	0.0	6.9	6.9	115.2	O K
960 min Winter	1.288	0.488	0.0	6.9	6.9	90.4	O K
1440 min Winter	1.091	0.291	0.0	6.8	6.8	54.0	O K
2160 min Winter	0.951	0.151	0.0	6.1	6.1	27.9	O K
2880 min Winter	0.916	0.116	0.0	5.0	5.0	21.4	O K
4320 min Winter	0.889	0.089	0.0	3.6	3.6	16.5	O K
5760 min Winter	0.877	0.077	0.0	2.9	2.9	14.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	0.915	0.0	382.2	4408
10080 min Summer	0.817	0.0	397.5	5136
15 min Winter	122.109	0.0	98.5	35
30 min Winter	79.770	0.0	129.0	48
60 min Winter	49.608	0.0	161.1	76
120 min Winter	30.192	0.0	196.2	128
180 min Winter	22.353	0.0	217.9	182
240 min Winter	17.949	0.0	233.3	236
360 min Winter	13.030	0.0	254.1	300
480 min Winter	10.320	0.0	268.4	376
600 min Winter	8.584	0.0	279.0	444
720 min Winter	7.370	0.0	287.5	512
960 min Winter	5.771	0.0	300.2	640
1440 min Winter	4.077	0.0	318.0	872
2160 min Winter	2.870	0.0	336.1	1176
2880 min Winter	2.241	0.0	349.7	1508
4320 min Winter	1.591	0.0	372.0	2208
5760 min Winter	1.256	0.0	391.9	2936

Summary of Results for 30 year Return Period (+35%)

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	0.869	0.069	0.0	2.4	2.4	12.7	O K
8640 min Winter	0.863	0.063	0.0	2.1	2.1	11.7	O K
10080 min Winter	0.859	0.059	0.0	1.9	1.9	11.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Discharge Volume (m^3)	Time-Peak (mins)
7200 min Winter	1.052	0.0	410.4	3672
8640 min Winter	0.915	0.0	428.2	4416
10080 min Winter	0.817	0.0	445.5	5144

Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 555900 363500 TF 55900 63500
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 %	+35

Time Area Diagram

Total Area (ha) 0.388

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.065	8	12	0.065	16	20	0.064
4	8	0.065	12	16	0.065	20	24	0.064

Model Details

Storage is Online Cover Level (m) 2.500

Complex Structure

Cellular Storage

Invert Level (m)	0.800	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	**Area (m²)**	**Inf. Area (m²)**	**Depth (m)**	**Area (m²)**	**Inf. Area (m²)**
0.000	195.0	0.0	2.600	0.0	0.0
0.200	195.0	0.0	2.800	0.0	0.0
0.400	195.0	0.0	3.000	0.0	0.0
0.600	195.0	0.0	3.200	0.0	0.0
0.800	195.0	0.0	3.400	0.0	0.0
1.000	195.0	0.0	3.600	0.0	0.0
1.200	195.0	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

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	4.8
Membrane Percolation (mm/hr)	1000	Length (m)	10.0
Max Percolation (l/s)	13.3	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	1.500	Cap Volume Depth (m)	0.350

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0120-6900-1200-6900
Design Head (m)	1.200
Design Flow (l/s)	6.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes

Hydro-Brake® Optimum Outflow Control

Diameter (mm) 120
Invert Level (m) 0.800
Minimum Outlet Pipe Diameter (mm) 150
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	6.9	Kick-Flo®	0.760	5.6
Flush-Flo™	0.356	6.9	Mean Flow over Head Range	-	6.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.2	1.200	6.9	3.000	10.6	7.000	15.9
0.200	6.5	1.400	7.4	3.500	11.4	7.500	16.4
0.300	6.9	1.600	7.9	4.000	12.2	8.000	16.9
0.400	6.9	1.800	8.3	4.500	12.9	8.500	17.4
0.500	6.8	2.000	8.8	5.000	13.5	9.000	17.9
0.600	6.5	2.200	9.2	5.500	14.2	9.500	18.4
0.800	5.7	2.400	9.5	6.000	14.8		
1.000	6.3	2.600	9.9	6.500	15.3		

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

Half Drain Time : 298 minutes.

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**
15 min Summer	1.385	0.585	0.0	6.9	6.9	108.3	O K
30 min Summer	1.566	0.766	0.0	6.9	6.9	142.9	O K
60 min Summer	1.728	0.928	0.0	6.9	6.9	175.3	O K
120 min Summer	1.833	1.033	0.0	6.9	6.9	196.2	O K
180 min Summer	1.868	1.068	0.0	6.9	6.9	203.0	O K
240 min Summer	1.871	1.071	0.0	6.9	6.9	203.5	O K
360 min Summer	1.845	1.045	0.0	6.9	6.9	198.6	O K
480 min Summer	1.812	1.012	0.0	6.9	6.9	191.9	O K
600 min Summer	1.774	0.974	0.0	6.9	6.9	184.4	O K
720 min Summer	1.735	0.935	0.0	6.9	6.9	176.6	O K
960 min Summer	1.653	0.853	0.0	6.9	6.9	160.2	O K
1440 min Summer	1.469	0.669	0.0	6.9	6.9	123.9	O K
2160 min Summer	1.236	0.436	0.0	6.9	6.9	80.8	O K
2880 min Summer	1.089	0.289	0.0	6.8	6.8	53.6	O K
4320 min Summer	0.955	0.155	0.0	6.2	6.2	28.6	O K
5760 min Summer	0.919	0.119	0.0	5.2	5.2	22.0	O K
7200 min Summer	0.901	0.101	0.0	4.3	4.3	18.8	O K

Storm Event	**Rain (mm/hr)**	**Flooded Volume (m³)**	**Discharge Volume (m³)**	**Time-Peak (mins)**
15 min Summer	164.078	0.0	118.4	36
30 min Summer	107.799	0.0	155.8	50
60 min Summer	67.713	0.0	196.4	76
120 min Summer	40.506	0.0	235.1	130
180 min Summer	29.881	0.0	260.2	186
240 min Summer	24.021	0.0	278.9	240
360 min Summer	17.578	0.0	306.2	302
480 min Summer	14.028	0.0	325.8	364
600 min Summer	11.740	0.0	340.9	432
720 min Summer	10.128	0.0	352.9	502
960 min Summer	7.987	0.0	371.0	640
1440 min Summer	5.671	0.0	395.1	898
2160 min Summer	3.983	0.0	416.5	1248
2880 min Summer	3.090	0.0	430.8	1580
4320 min Summer	2.156	0.0	450.6	2248
5760 min Summer	1.674	0.0	466.8	2944
7200 min Summer	1.382	0.0	481.4	3672

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Σ Max Outflow (l/s)	Max Volume (m^3)	Status
8640 min Summer	0.891	0.091	0.0	3.8	3.8	16.9	O K
10080 min Summer	0.884	0.084	0.0	3.3	3.3	15.5	O K
15 min Winter	1.462	0.662	0.0	6.9	6.9	122.5	O K
30 min Winter	1.659	0.859	0.0	6.9	6.9	161.5	O K
60 min Winter	1.843	1.043	0.0	6.9	6.9	198.2	O K
120 min Winter	1.978	1.178	0.0	6.9	6.9	223.3	O K
180 min Winter	2.033	1.233	0.0	7.0	7.0	232.4	O K
240 min Winter	2.051	1.251	0.0	7.0	7.0	234.5	O K
360 min Winter	2.008	1.208	0.0	6.9	6.9	228.7	O K
480 min Winter	1.962	1.162	0.0	6.9	6.9	220.4	O K
600 min Winter	1.909	1.109	0.0	6.9	6.9	210.5	O K
720 min Winter	1.850	1.050	0.0	6.9	6.9	199.6	O K
960 min Winter	1.735	0.935	0.0	6.9	6.9	176.5	O K
1440 min Winter	1.465	0.665	0.0	6.9	6.9	123.2	O K
2160 min Winter	1.140	0.340	0.0	6.9	6.9	63.1	O K
2880 min Winter	0.987	0.187	0.0	6.4	6.4	34.6	O K
4320 min Winter	0.913	0.113	0.0	4.9	4.9	20.9	O K
5760 min Winter	0.892	0.092	0.0	3.8	3.8	17.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Discharge Volume (m^3)	Time-Peak (mins)
8640 min Summer	1.185	0.0	495.2	4400
10080 min Summer	1.044	0.0	508.6	5136
15 min Winter	164.078	0.0	132.7	36
30 min Winter	107.799	0.0	174.5	50
60 min Winter	67.713	0.0	220.1	76
120 min Winter	40.506	0.0	263.4	130
180 min Winter	29.881	0.0	291.5	184
240 min Winter	24.021	0.0	312.5	238
360 min Winter	17.578	0.0	343.0	336
480 min Winter	14.028	0.0	365.0	386
600 min Winter	11.740	0.0	381.8	462
720 min Winter	10.128	0.0	395.3	540
960 min Winter	7.987	0.0	415.6	694
1440 min Winter	5.671	0.0	442.6	966
2160 min Winter	3.983	0.0	466.6	1288
2880 min Winter	3.090	0.0	482.6	1588
4320 min Winter	2.156	0.0	504.8	2220
5760 min Winter	1.674	0.0	522.9	2944

Summary of Results for 100 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**
7200 min Winter	0.881	0.081	0.0	3.2	3.2	15.1	O K
8640 min Winter	0.874	0.074	0.0	2.7	2.7	13.7	O K
10080 min Winter	0.869	0.069	0.0	2.4	2.4	12.7	O K

Storm Event	**Rain (mm/hr)**	**Flooded Volume (m³)**	**Discharge Volume (m³)**	**Time-Peak (mins)**
7200 min Winter	1.382	0.0	539.3	3680
8640 min Winter	1.185	0.0	554.8	4416
10080 min Winter	1.044	0.0	569.9	5088

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 555900 363500 TF 55900 63500
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) 0.388

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.065	8	12	0.065	16	20	0.064
4	8	0.065	12	16	0.065	20	24	0.064

Model Details

Storage is Online Cover Level (m) 2.500

Complex Structure

Cellular Storage

Invert Level (m)	0.800	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	**Area (m²)**	**Inf. Area (m²)**	**Depth (m)**	**Area (m²)**	**Inf. Area (m²)**
0.000	195.0	0.0	2.600	0.0	0.0
0.200	195.0	0.0	2.800	0.0	0.0
0.400	195.0	0.0	3.000	0.0	0.0
0.600	195.0	0.0	3.200	0.0	0.0
0.800	195.0	0.0	3.400	0.0	0.0
1.000	195.0	0.0	3.600	0.0	0.0
1.200	195.0	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

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	4.8
Membrane Percolation (mm/hr)	1000	Length (m)	10.0
Max Percolation (l/s)	13.3	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	1.500	Cap Volume Depth (m)	0.350

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0120-6900-1200-6900
Design Head (m)	1.200
Design Flow (l/s)	6.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes

Hydro-Brake® Optimum Outflow Control

Diameter (mm) 120
Invert Level (m) 0.800
Minimum Outlet Pipe Diameter (mm) 150
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	6.9	Kick-Flo®	0.760	5.6
Flush-Flo™	0.356	6.9	Mean Flow over Head Range	-	6.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.2	1.200	6.9	3.000	10.6	7.000	15.9
0.200	6.5	1.400	7.4	3.500	11.4	7.500	16.4
0.300	6.9	1.600	7.9	4.000	12.2	8.000	16.9
0.400	6.9	1.800	8.3	4.500	12.9	8.500	17.4
0.500	6.8	2.000	8.8	5.000	13.5	9.000	17.9
0.600	6.5	2.200	9.2	5.500	14.2	9.500	18.4
0.800	5.7	2.400	9.5	6.000	14.8		
1.000	6.3	2.600	9.9	6.500	15.3		

Appendix L Pollutant Control Chamber Details

ACO Water Management:
Civils + Infrastructure

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

ACO QuadraCeptor

Deutsches Institut für Bautechnik DIBt

ACO QuadraCeptor

Four Stage Surface Water Treatment Unit

ACO

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

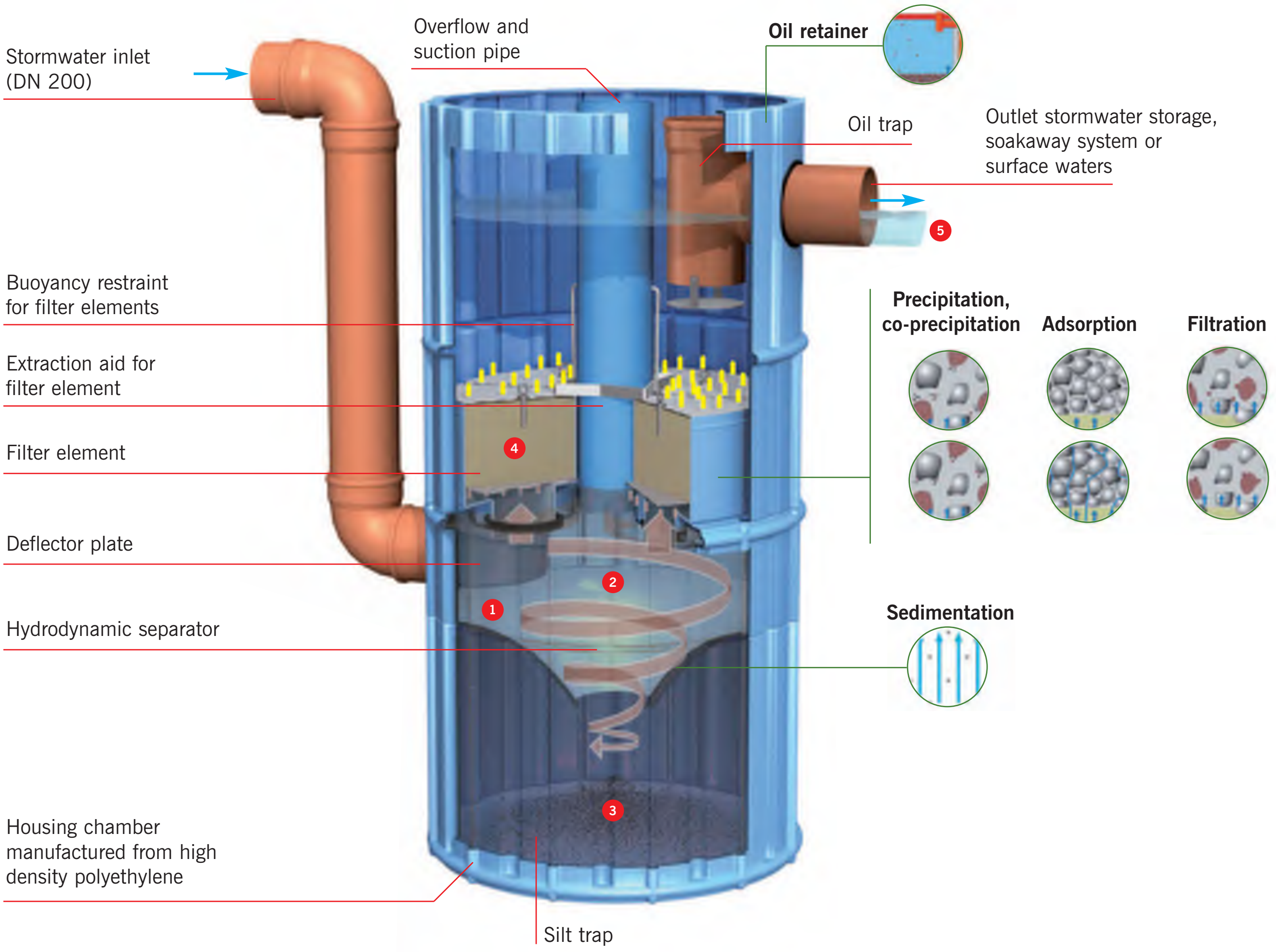
The settlable solids are retained in the silt trap chamber. This chamber should be emptied periodically, via the central by-pass tube.

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:

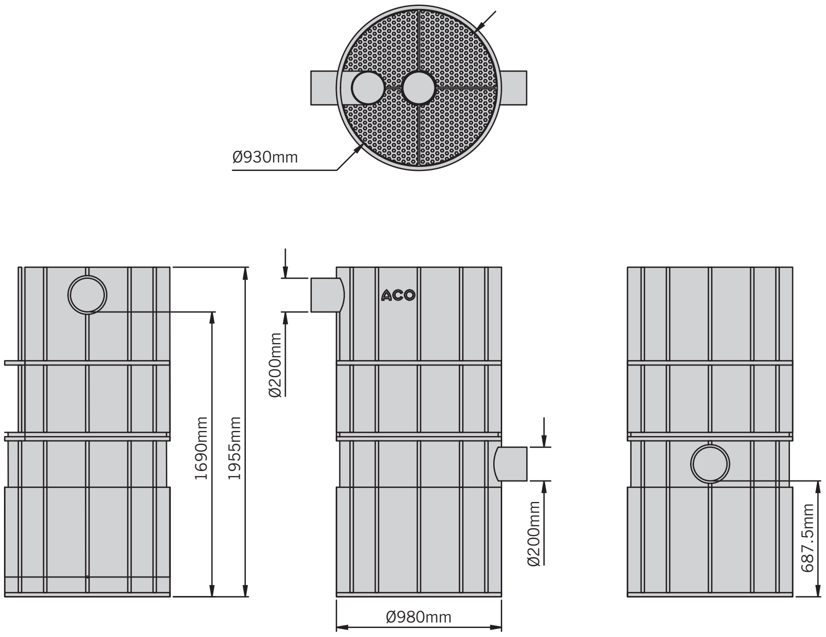
R1000 (Roof)	**Application:** Roof areas that do not have a significant proportion of uncoated metals* **Material:** Filter Substrate: Roof **Weight of filter element:** 34kg **Total weight of ACO QuadraCeptor unit including polyethylene housing:** 220kg
T750 (Traffic)	**Application:** Trafficked areas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

***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 (m²)	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

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

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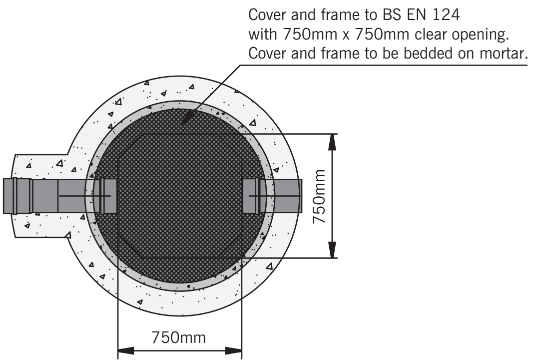
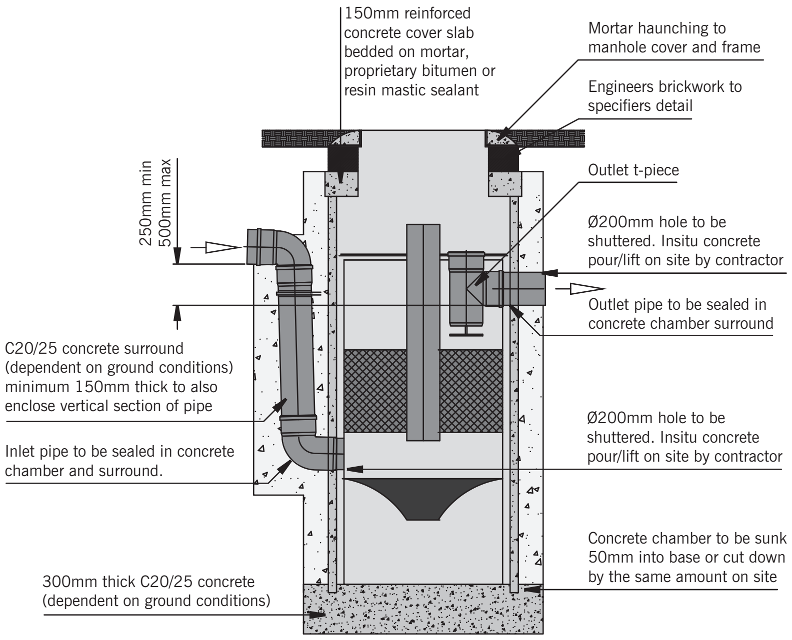
Installation detail

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 aind 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 Quadraceptor 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 Quadraceptor 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 Quadraceptor 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.

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NBS Specification

ACO Quadraceptor 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

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

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ISO 9001
FM 13502

ISO 14001
EMS 538781

OHSAS 18001
OHS 524145