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**Trubs Farm
Flood Risk Assessment**

**Prepared for MCI
DEVELOPMENT**

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Contents

Table of Contents

Abbreviations 4

1.0 Introduction 5

2.0 Planning Policy..... 6

3.0 Requirements of a Flood Risk Assessment..... 9

4.0 Sequential Test 11

5.0 Site Context 12

6.0 Proposed Development..... [14](#)

8.0 Flood Hazards & Sources of Flooding 24

11.0 Climate Change 28

12.0 Conclusions & Recommendations..... 29

Appendices

APPENDIX A Extract from NPPF – Flood Risk

APPENDIX B Topographical Survey

APPENDIX C Greenfield Runoff

APPENDIX D Pond Calcs

APPENDIX E Microdrainage

APPENDIX F Drainage Layout

ABBREVIATIONS

Term	Meaning / Definition
AEP	Annual Exceedance Probability
BGL	Below Ground Level
BGS	British Geological Society
CFMP	Catchment Flood Management Plan
CIRIA	Construction Industry Research and Information Association
CoP	Code of Practice
EA	Environment Agency
EFO	Extreme Flood Outline (Boundary of floodplain associated with a flood event with a probability of occurrence of 0.1%, 1 in 1000 years)
FDA	Flood Defence Agency (e.g. Environment Agency)
FERS	Flood Event Recording System
FFL	Finished Floor Level
FRA	Flood Risk Assessment
FW	Foul Water
GPZ	Groundwater Protection Zone
LDD	Local Development Document
LDF	Local Development Framework
LHA	Local Highway Authority
LPA	Local Planning Authority
m AOD	Metres above Ordnance Datum
MAF	Mean Annual Flood
NGR	National Grid Reference
OS	Ordnance Survey
PPG	Planning Policy Guidance
PPS	Planning Policy Statement
SFRA	Strategic Flood Risk Assessment
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
SW	Surface Water
WFD	Water Framework Directive

INTRODUCTION

PURPOSE OF THIS REPORT

MCI Developments are proposing a new residential development on Trubs Farm, Rochedale. Total area of the site is approximately 4.8ha.

The Local Planning Authority has requested that a Flood Risk Assessment (FRA) is undertaken to assess the risk of flooding to the site.

ELLUC Projects Limited has been commissioned by MCI Developments to prepare a formal Flood Risk Assessment to accompany the planning application.

REQUIREMENT FOR THIS REPORT

The application site is located in Flood Zone 1, (land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1% Annual Exceedance Probability (AEP)) in any one year.

Given that the site is greater than 1 Ha, in accordance with the National Planning Policy Framework

(NPPF) and the Planning Practice Guidance (Flood Risk & Coastal Change) (PPG), a Flood Risk Assessment (FRA) and Drainage Strategy is required to support the planning application.

PLANNING POLICY

NATIONAL PLANNING POLICY

The National Planning Policy Framework (NPPF)¹ clearly identifies flood risk as a specific material consideration in the Planning Process and in the allocation and release of sites for development or re-development.

NPPF builds on its predecessor (PPS 25) and seeks to further strengthen the co-ordination between land-use planning and development planning and the operational delivery of flood and coastal defence strategy. NPPF retains key elements of PPS 25 continuing to encourage Local Planning Authorities to use their existing powers to guide, regulate and control development in relation to flooding and flood risk. NPPF expects Local Authorities to adopt a risk-based approach at all levels of Planning, through the application of the Sequential Test detailed in Table 1 and 2, of the Technical Guidance to NPPF document, a copy of which is attached in Appendix A.

The aim of the sequential test is to steer new development to areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding. The Strategic Flood Risk Assessment will provide the basis for applying this test. A sequential approach should be used in areas known to be at risk from any form of flooding.

The Water Resources Act 1991 [Section 105] also requires the Environment Agency to exercise a general supervision over all flood defence matters, including flood plains and washlands which accommodate waters during periods of flood. In discharging their functions, the Agency from time to time carries out comprehensive surveys and flood studies, largely of 'main rivers' within its jurisdiction.

A Section 105 Study involves the Agency topographically surveying the subject watercourse (or parts of it) and obtaining details of the flow mechanics within the watercourse. This data then enables them to generate a comprehensive hydraulic computer model for the watercourse. From this hydraulic model, the EA are able to define the approximate extent of fluvial floodplain associated with the 1 in 100-year (1% annual probability) flooding event or the extent of tidal floodplain associated with the 1 in 200-year (0.5% annual probability) flooding event.

The extents of the modelled floodplain are then provided to Local Planning Authorities, to enable them to make more informed decisions when considering proposed development in flood-susceptible areas. If development is proposed in a flood-susceptible area, or in an area where there is a history of flooding, the EA, as a statutory consultee in the Planning Process, will generally recommend that the risk of flooding be formally assessed, in

¹ National Planning Policy Framework

accordance with NPPF, and that a Flood Risk Assessment report be produced to support the Planning Application. The broader modelled flood extents are also indicated on the EA's Flood Zone Maps, available through their website².

Local Planning Policy

Catchment Flood Management Plan (CFMP)

The site is located within the Wyre catchment area. The Environment Agency has produced the 'Wyre Catchment Flood Management Plan'³. A copy of the CFMP is available from the EA on request.

CFMP's are not specifically required by the Water Framework Directive ⁴ and are prepared voluntarily by the EA (under Government sponsorship). A CFMP is a high-level strategic plan for an area which aims to develop policies to manage flood risk over the next 50 to 100 years. These policies take into account the likely impacts of climate change and the effects of land-use and land management and identify a range of benefits which contribute towards sustainable development. The CFMP's policies establish whether action should be taken to increase, decrease or maintain the current level of flood risk.

Strategic Flood Risk Assessment (SFRA)

Local Planning Authorities are required to produce Local Development Frameworks, which are a portfolio of Local Development Documents that collectively deliver the spatial planning strategy for the Authority area. The LDD's undergo a Sustainability Appraisal which assists Planning Authorities in ensuring their policies fulfill the principles of sustainability. Strategic Flood Risk Assessments are one of the documents to be used as the evidence base for planning decisions and are a component of the Sustainability Appraisal process. Therefore, SFRAs should be used in the review or production of LDD's.

To assist Local Planning Authorities in their strategic land-use planning, SFRA's should present sufficient information to enable Local Authorities to apply the Sequential Test to their proposed development sites: *"Decision-makers should use the SFRA to inform their knowledge of flooding, refine the information on the Flood Map and determine the variations in flood risk from all sources of flooding across and from their area. These should form the basis for preparing appropriate policies for flood risk management for these areas."* ⁵

² www.environment-agency.gov.uk

⁴ www.defra.gov.uk/environment/water/wfd/index.htm

⁵ NPPF

FRA Level	Description / Scope
Level 1	Screening Study to identify whether there are any flooding or surface water management issues related to a development site that may warrant further consideration. This should be based on readily available existing information, including the SFRA, Environment Agency Flood Map and Standing Advice. The Screening Study will ascertain whether a FRA is required.
Level 2	Scoping Study to be undertaken if the Level 1 FRA indicates that the site may lie within an area that is at risk of flooding or that the site may increase flood risk due to increased run-off. This Study should confirm the sources of flooding which may affect the site and should include the following: • an appraisal of the availability and adequacy of existing information; • a qualitative appraisal of the flood risk posed to the site, and potential impact of the development on flood risk elsewhere; • an appraisal of the scope of possible measures to reduce the flood risk to acceptable levels. The Scoping Study may identify that sufficient quantitative information is already available to complete a FRA appropriate to the scale and nature of the development.
Level 3	Detailed Study to be undertaken if the Level 2 FRA concludes that further quantitative analysis is required to assess flood risk issues related to the development site. The Study should include: • quantitative appraisal of the potential flood risk to the development; • Quantitative appraisal of the potential impact of development site on flood risk elsewhere; • quantitative demonstration of the effectiveness of any proposed mitigation measures.

It is considered that a Level 2 Scoping Study is appropriate at this stage and to minimise pre-commencement conditions this report has therefore been based on the requirements of a Level 2 Study.

REQUIREMENTS OF A FLOOD RISK ASSESSMENT

The EA's Flood Zone Maps, available on the EA's website, indicate that the site is wholly within a Flood Zone 1. Flood Zone 1 is an area of high risk of flooding, with a risk of flooding lower than 1 in 1000 year event. Current EA guidance indicates that all proposed developments in this zone should be accompanied by an FRA for a development site with an area of over 1 hectare, or the Local Authority have requested one, as in this situation. An FRA should contain:

- Information about the surface water disposal measures already in place and their state of maintenance;
- An assessment of the volume of surface water run-off likely to be generated from the proposed development;
- Information on how that surface water run-off will be disposed of (from the new development);
- Estimates of how climate change could affect the probability and intensity of flooding events in the future;
- Information about any other potential sources of flooding to the site - streams, ditches, sewers, groundwater, overland surface water flow or any combination of these.

As set out in NPPF flood risk assessments should identify and assess the risks of all forms of flooding to and from the development and demonstrate how these flood risks will be managed so that the development remains safe throughout its lifetime, taking climate change into account.

The detail and complexity of a Flood Risk Assessment should reflect the level of risk to the proposed development and should:

- be proportionate to the risk and appropriate to the scale, nature and location of the development;
- consider the risk of flooding arising from the development in addition to the risk of flooding to the development;
- take the impacts of climate change into account;
- be undertaken by competent people, as early as possible in the particular planning process, to avoid misplaced effort and raising landowner expectations where land is unsuitable for development;
- consider both the potential adverse and beneficial effects of flood risk management infrastructure including raised defences, flow channels, flood storage areas and other artificial features together with the consequences of their failure;
- consider the vulnerability of those that could occupy and use the development, taking account of the Sequential and Exception Tests and the vulnerability classification (including arrangements for safe access;

- consider and quantify the different types of flooding (whether from natural and human sources and including joint and cumulative effects) and identify flood risk reduction measures, so that assessments are fit for the purpose of the decisions being made;
- consider the effects of a range of flooding events including extreme events on people, property, the natural and historic environment and river and coastal processes;
- include the assessment of the remaining (known as ‘residual’) risk after risk reduction measures have been taken into account and demonstrate that this is acceptable for the particular development or land use;
- consider how the ability of water to soak into the ground may change with development, along with how the proposed layout of development may affect drainage systems;
- be supported by appropriate data and information, including historical information on previous events.

SEQUENTIAL TEST

The sequential test is to ensure that a sequential approach is followed to steer new development to areas with the lowest probability of flooding. The aim is to steer new developments to Flood Zone 1 (areas with a low probability of river or sea flooding).

The proposed development is set within Flood Zone 1.

The proposed residential development will be categorised as ‘more vulnerable’ as classed within NPPF.

Table 4.5 Flood Risk Vulnerability Classification Chart (NPPF)

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

Key:

✓ Development is appropriate

✗ Development should not be permitted.

Based upon the Flood risk Vulnerability classification the development site is classed as appropriate and therefore the sequential test is past.

1. SITE CONTEXT

1.1. SITE LOCATION

The closest address to the site is Trub, Castleton, Rochdale, Greater Manchester, England, OL11 2QH, United Kingdom.

The site is located on grass field. Situated to the north is Castleton Train Station. Rochdale Canal forms the western boundary of the site. Situated east of the site beyond Manchester Road consists of residential development properties. The total site area within the red line boundary is 4.96Ha.

According to the Topographical Survey (Appendix B) the site falls north to south. The levels north of the site range between 131.50m AOD to 136.16m AOD. The levels south of the site range between 130.00m AOD and 120.00m AOD

Figure (1-1) below shows the site location.

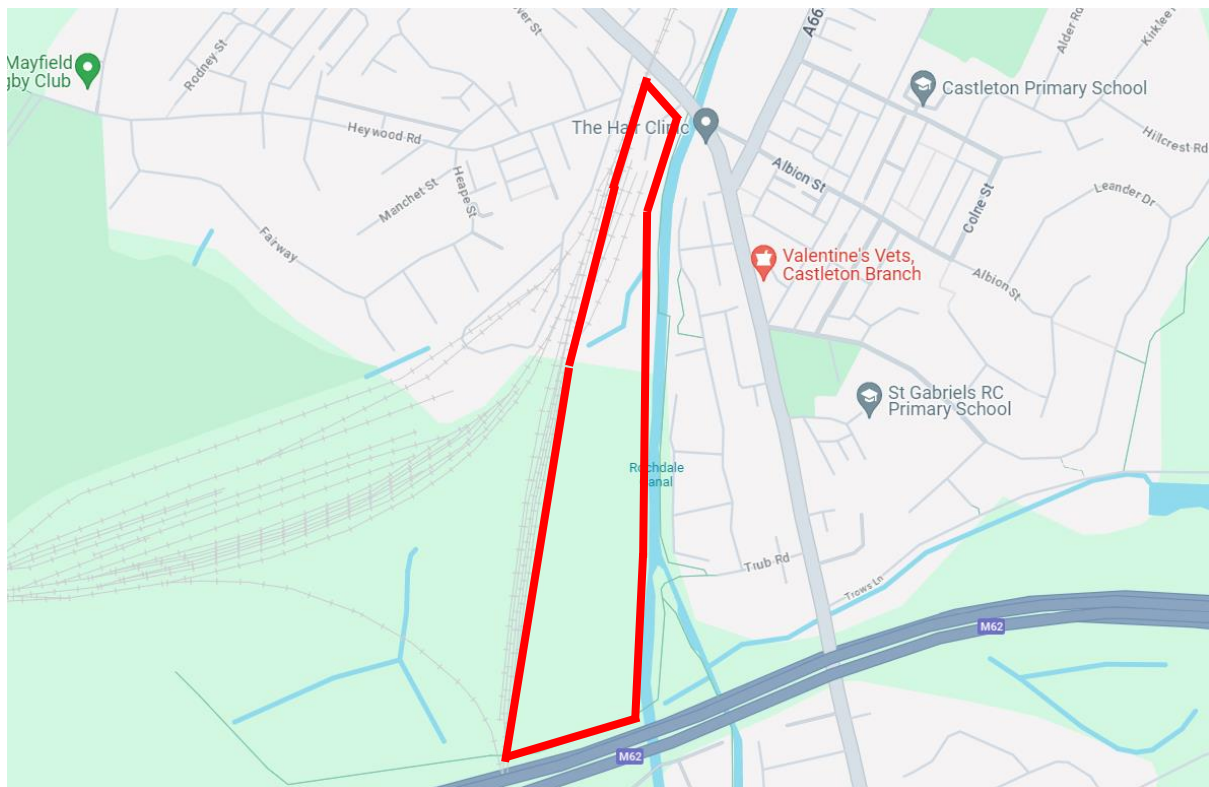


FIGURE 1-1 - SITE LOCATION PLAN

1.2. WATERCOURSES

The nearest 'Main River' (Regulated by the Environment Agency) to the site is the River Roch and is located approximately 2.00km north west of the site at its nearest point.

An Ordinary Watercourse 'Trub Brook' is located at the southern boundary of the site which flows East to west along the southern boundary of the site.

1.3. Ground Conditions

1.3.1. Geology

A review of the British Geological Survey (BGS) online geological mapping indicates that the bedrock of the site is Pennine Lower Coal Measures Formation - Mudstone, siltstone and sandstone. Superficial deposits of Glaciofluvial Deposits, Devensian - Sand and gravel.

1.4. Soil

DEFRA's Magic Online Mapping tool indicates that the site is underlain mainly by 'Freely draining slightly acid sandy soils.

1.4.1. Hydrogeology

DEFRA's Magic Online Mapping tool indicates that the bedrock is classified as a Secondary A, these comprise permeable layers that can support local water supplies and may form an important source of base flow to rivers.

The site is not located within a groundwater Source Protection Zone (S

2. FLOOD RISK

2.1. FLUVIAL FLOOD RISK

The Environment Agency Flood Map for Planning below in Figure 2-1 indicates that the site is located entirely within Flood Zone 1 and therefore a low risk from fluvial flooding. The land to the west adjacent to and beyond River don lies within Flood Zone 1.

There is a watercourse approximately 190m south of the site that connects to wine brook which has Flood Zone 3 and Flood Zone 2 along its course. However, these zones of influence do not encroach within the site boundary and so it is not considered to pose a risk to the site.

Trubs Brook runs along the southern boundary of the site from east to west and is culverted for a significant section of its run alongside the site. Therefore it can be considered to be a low risk of fluvial flooding.

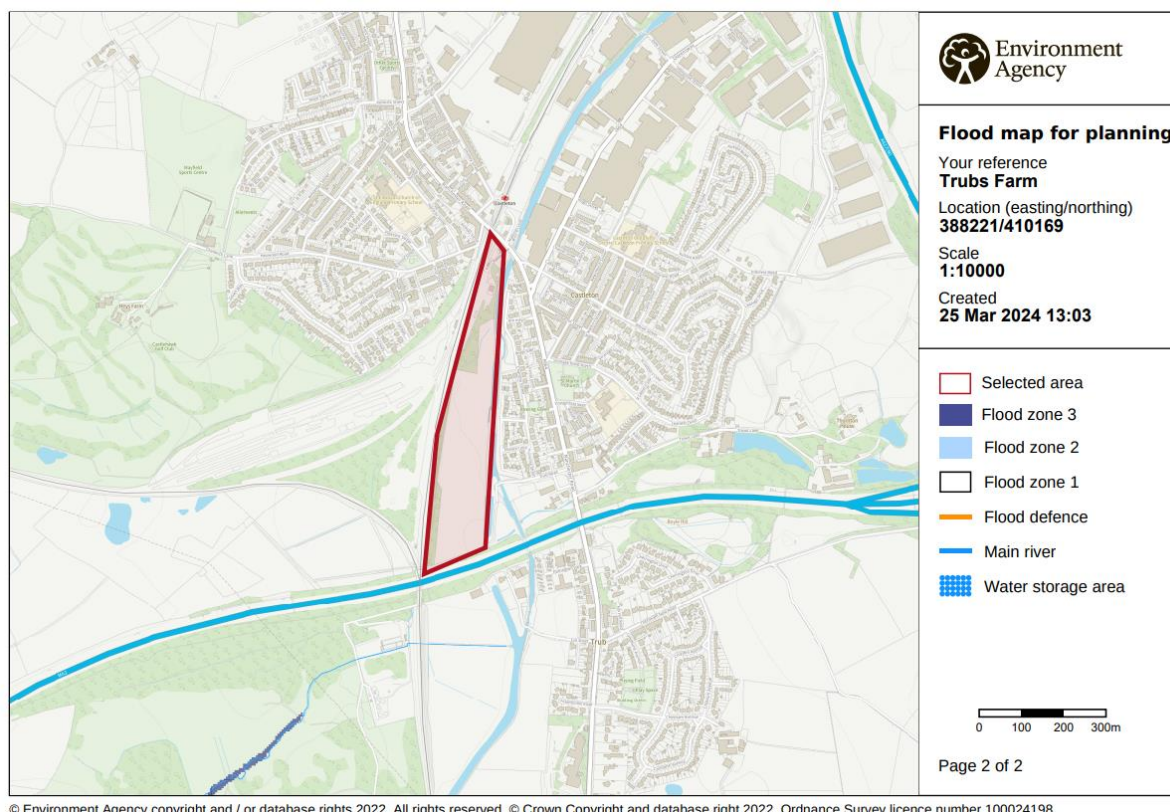


FIGURE 2-1 - FLOOD MAP FOR PLANNING

2.2. Surface water and overland flows Flood Risk

The Environment Agency's Surface Water Flood Map in Figure below in figure 2-2 indicates the extent of surface water flooding within the site. This demonstrates that the area can be considered to be at medium to high risk.

The highest risk of surface water flooding is indicated southwest of the site boundary. This is due to the lowest area of the site being located within this area. As stated in the site context section the site falls from north to south which explains the ponding of surface water flooding nearer south of the south.

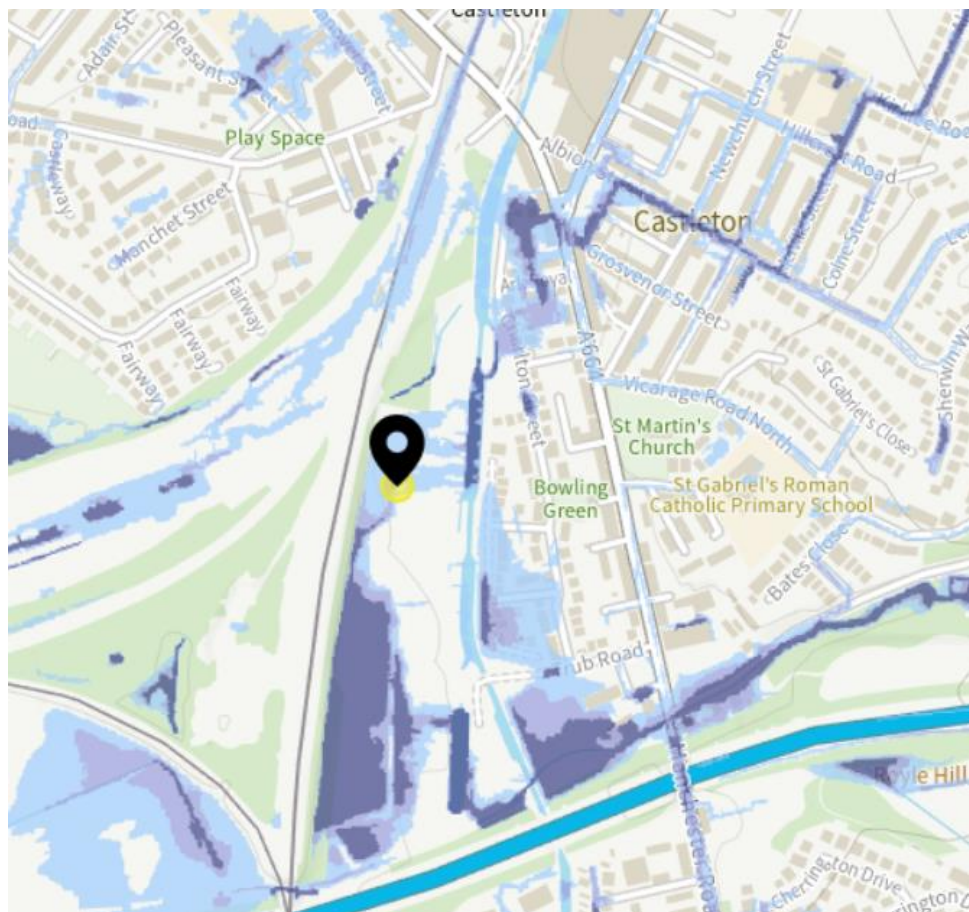


FIGURE 2-2 - EXTENT OF FLOODING FROM SURFACE WATER

2.3. Groundwater Flooding

A Review of Rochdale's Borough Strategy for Flood Risk Management 2014-2024 highlighted below in figure 2-3 indicates that the site is within an area that is susceptible to groundwater.

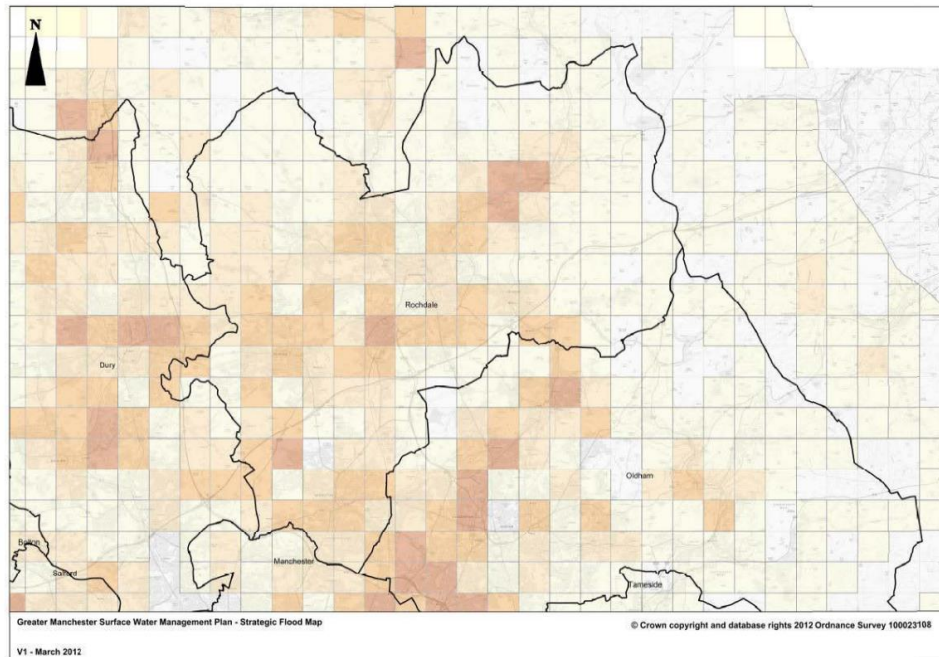


FIGURE 2-3 - GROUNDWATER SUSCEPTIBILITY MAP

2.4 Canal Flooding

- 3 Flooding from a canal occurs when the canal is overtopped or breaches due to failure. Rochdale forms the eastern boundary of the site. From the topographical survey the levels around the canal are higher than that of the site. Therefore, if there were to be a leakage of the canal this could potential put thye site at risk. However, as canals have various features which allow for regulation of water flow their flood risk is generally low.

3.0 PLANNING POLICY AND GUIDANCE

The LLFA for the site is RBC (Rochdale Borough Council). The following national and local policies should be adhered to:

National Planning Policy Framework

2.1. In accordance with the NPPF a formal FRA is required in support of a planning application for development sites located within Flood Zone 1 that is more than 1 hectare (ha). The level of detail within an FRA should be appropriate to the scale and nature of the development.

2.2. Sequential & Exception Tests

2.3. One of the aims of NPPF is to steer development away from flood zones of high flood risk towards Flood Zone 1. The proposed development components are classified as 'more vulnerable'. In accordance with Table 2 of the Flood Risk Vulnerability and flood zone 'incompatibility'.

2.4. Give that the site is in Flood Zone 1 and the development is 'more vulnerable', the proposed development is considered appropriate on the flood risk terms and therefore the sequential test is considered passed.

2.5. Rochdale Borough Unitary Development Plan

2.6. The Development Plan (2006) includes objectives such as:

2.7. EM/7 DEVELOPMENT AND FLOOD RISK

- a) It will not increase the risk of flooding within the flood plain or in adjoining areas by reducing flood storage capacity, increasing flows within a flood plain or through the additional discharge of surface water;
- b) It will not itself be at risk from flooding;
- c) Appropriate sustainable drainage systems are used;
- d) Adequate access adjacent to the water course for maintenance is provided;
- e) Existing or proposed flood defences are protected;
- f) It would not result in extensive culverting; and
- g) Flood defence works required as a consequence of development are provided at the developer's expense

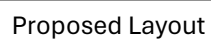
DEVELOPMENT PROPOSAL

PROPOSED DEVELOPMENT (CONCEPT DESIGN)

The proposed development is the following.

Erection of 179 units

- Apartment 1 – 24 Units
- Apartment 2 – 24 units
- Ashburn – 16 units
- Padbury – 37 units
- Seacort – 32 units
- Holgate – 15 units
- Farley – 13 units
- Selset – 6 units
- Winterborne – 8 units
- Thronton - 4 units



4.0 PROPOSED DRAINAGE

4.1 SURFACE WATER DRAINAGE OPTIONS

The BGS maps indicate that the geology of the site consists of Pennine Lower Coal Measures Formation – Mudstone. It is anticipated that soakaways will be feasible on the site subject to remediation of any contamination.

To ensure that post-development run-off volumes and peak flow rates discharging from the site do not exceed current levels, it may be necessary to employ SuDS (Sustainable Drainage Systems) methods and source control techniques, including flow control devices to restrict flows and to store attenuated water on site. The provision of such techniques will ensure that the maximum discharge from the site does not exceed the agreed rates with the statutory bodies. In addition, where practicable, opportunities for reducing flood risk through the management of surface water run-off from the site should be included.

Storage of attenuated flows within the site could be provided in a number of ways:

- underground – over-sized pipes / tanks or proprietary storage systems such as ‘Stormcell’;
- above ground – storage / balancing pond, designated surface areas (low risk areas such as car parks, open space);
- combination of underground and above ground.

Proposed SW drainage systems are generally designed in accordance with ‘Sewers for Adoption’⁶, which requires that any surface water drainage system, which is proposed to be Adopted after construction, should not surcharge during the 1 in 5-year storm event, and should not produce any surface flooding during a 1 in 30-year storm event (i.e. all run-off contained wholly within the sewerage system during the 1 in 30-year event).

It is generally accepted that a degree of surface flooding can be permitted during extreme storm events, subject to specific surface areas being designated as flood-susceptible and subject to flooding of these areas posing little or no risk to human life and/or damage to property. Examples of surface areas which might be permitted to flood during extreme events are:

- Agricultural land;
- Recreational land (playing fields etc.);
- Landscaped areas;
- Car parks;
- Other non-inhabited, designated areas.

⁶‘Sewers for Adoption’ 7th Edition, published by WRc Plc., March 2006

In all cases where surface flooding might be permitted or designed in to a scheme, due diligence needs to be given to NPPF and the need to make potential users of such areas aware of their functionality and purpose, and the requirement to maintain safe access and egress at all times.

The Building Regulations Approved Document H (2002) outlines a hierarchy of potential methods of disposing of surface water from a site:

- A soakaway; or where that is not practicable
- A watercourse or river; or where that is not practicable,
- A sewer.

The viability of this hierarchy has been assessed below:

4.2 SOAKAWAY

According to the BGS survey the ground is Singleton Mudstone Member Formation. Soakaways are feasible at this site via an infiltration basin.

4.3 WATERCOURSES / WATER BODIES

There is a watercourse running to the southern boundary of the site, however following onsite investigations watercourse is not suitable due to no outfall.

4.4 SEWERS

The foul water will drain to the diverted combined sewer running to along the eastern boundary at an unrestricted rate.

Below is a chart based on table 1.1 typical SuDS components within CIRIA Guidance 697 SuDS manual. This discusses the viable SuDS components and whether they are useable for this site.

Component	Description	Is it viable
Filter Strips	These are wide, gently sloping areas of grass or other dense vegetation that treat runoff from adjacent impermeable areas.	Infiltration is not likely to be successful therefore this type of SuDS system should not be viable on the site.
Swales	Swales are broad, shallow channels covered by grass or other suitable vegetation. They are designed to convey and/or store runoff, and can infiltrate the water into the ground (if ground conditions allow)	Infiltration is not likely to be successful therefore this type of SuDS system should not be viable on the site.
Infiltration Basins	Infiltration basins are depressions in the surface that are designed to store runoff and infiltrate the water to the ground. They may also be landscaped to provide aesthetic and amenity value	Infiltration is likely to be successful therefore this type of SuDS system should not be viable on the site.

Wet Ponds	Wet ponds are basins that have a permanent pool of water for water quality treatment. They provide temporary storage for additional storm runoff above the permanent water level. Wet ponds may provide amenity and wildlife benefits	Wet pond is not suitable for the site
Extended detention basins	Extended detention basins are normally dry, though they may have small permanent pools at the inlet and outlet. They are designed to detain a certain volume of runoff as well as providing water quality treatment.	Detention basin will not be used for storage on the site.
Constructed Wetland	Constructed wetlands are ponds with shallow areas and wetland vegetation to improve pollutant removal and enhance wildlife habitat	Constructed wetland would not be possible Therefore this type of SuDS is unsuitable.
Filter drains and perforated pipes	Filter drains are trenches that are filled with permeable material. Surface water from the edge of paved areas flows into the trenches, is filtered and conveyed to other parts of the site. A slotted or perforated pipe may be built into the base of the trench to collect and convey the water.	Infiltration is not likely to be successful therefore this type of SuDS system should not be viable on the site.
Infiltration devices	Infiltration devices temporarily store runoff from a development and allow it to percolate into the ground.	Infiltration is not likely to be successful therefore this type of SuDS system should not be viable on the site.
Pervious surfaces	Pervious surfaces allow rainwater to infiltrate through the surface into an underlying storage layer, where water is stored before infiltration to the ground, reuse, or release to surface water	Infiltration is not likely to be successful therefore this type of SuDS system should not be viable on the site.
Green Roofs	Green roofs are system which cover a building's roof with vegetation. They are laid over a drainage layer, with other layers providing protection, waterproofing and insulation.	Green roofs are not viable on this site due to the heavy maintenance
Oversized Pipes / Tanks	Oversized pipes and cellular are pipes below ground that hold surface water.	These should be viable and will not be used within the site.

4.5 SURFACE WATER DRAINAGE STRATEGY

The surface water will discharge to an infiltration basin at the southern boundary of the site hence all the drainage run off are dealt within the boundary of the development.

Drainage Layout can be seen in Appendix F.

The Qbar of the site is estimated to 28.5l/s.

The proposed surface water network has been designed using Microdrainage flow simulation software to ensure the following:

- No surcharging of drainage network for Design Storm of 1 in 2 years.
- No flooding for design flood frequency of 1 in 30 years.
- 1:100 year + 40% model should be duly reviewed and flood routing plans prepared as part of the detailed site designs.
- Maintenance of the drainage will be undertaken by MCI Developments until adopted and/or transferred to a management company.

5 Flood Hazards & Sources of Flooding

5.1 POTENTIAL FLOOD HAZARDS

Prior to undertaking an FRA, the different types of flooding mechanisms which may affect the site need to be identified and then assessed to determine whether the development site is located within an area which is at risk of flooding from one or more of the applicable mechanisms.

CIRIA Report C624 ⁷, Table A2.1, lists a number of key factors that should be considered during a Level 1 FRA. This table can be used to summarise the findings of a Level 1 FRA study and to identify those flood hazards which may be applicable to the site in question. The boxes shaded grey indicate those sources of flooding which are unlikely to be identified for each question. If sufficient information is not available to identify the specific source of flooding, then all possible sources should be ticked. If a tick is placed below any flood hazard then a Level 2 FRA will be required to assess flood risk issues relating to that hazard in more detail.

Table 8.1 below identifies the flood hazards applicable to this site.

⁷CIRIA publication 'C624 Development and Flood Risk – Guidance for the Construction Industry'

Table 5.1 Flood Hazard Identification

Question	Flood Hazard						
	Fluvial	Sea	Estuaries	Groundwater	Overland flow	Artificial drainage systems	Infrastructure failure
Is the development site next to the sea or any watercourse shown on Ordnance Survey maps?	x	x	x				
Is the development site, or part of the development site, identified as being at risk of flooding within available documentation?	x	x	x	x	x	x	x
If a strategic flood risk assessment is available, is the development site, or part of the development site, identified as being at risk of flooding?	x	x	x	x	x	x	x
If a flood zone map is available, is the development site, or part of the development site, within a High Risk zone?	x	x	x				
If a flood zone map is available, is the development site, or part of the development site, within a Low to Medium Risk zone?	✓	x	x				
If a flood zone map is not available, is the development site, or part of the development site, situated on alluvium based on consideration of geological maps of the area?	x	x	x				
If there is an existing property on, or next to the site at the same level, is the property within a flood warning area?	x	x	x	x			
Are the LPA / FDA aware of any existing, historical or potential flooding problems that may affect the site?	x	x	x	x	x	x	x
Do the physical characteristics of the site suggest that it may be prone to flooding?	x	x	x	x	x	x	x
If a flood zone map is not available, is the development site, or part of the development site below 10m AOD AND does the FDA consider the development to be at risk of tidal flooding?		x	x				
Is the development located within a natural or artificial hollow, or at the base of a valley or at the bottom of a hill slope?				x	x		
Does examination of historical maps indicate any likelihood of flood risk at the site?	x	x	x	x	x		
Do the names of surrounding roads, areas or houses suggest the possibility of seasonal or historical flooding?	x	x	x	x	x		
Is the site likely to involve excavation / construction below existing ground levels (excluding foundations)?	x	x	x	x	x		
Is the land use upslope of the site such that the generation of overland flow may be encouraged, and can water from this area flow onto the site?					x		
Are there any artificial drainage systems on or next to the site, at the same level, or upslope of, the site?						x	x
Is the development site protected by an existing flood defence?	x	x	x			x	x
Is the development site protected by a flood control structure (e.g. flap valve, sluice gate, tidal barrier etc)	x	x	x			x	x
Is the development site located upstream of a culvert which may be prone to	x		x	x	x	x	x

blockage?							
Are water levels in a watercourse located in or next to a development site controlled by a pumping station?	x	x	x	x	x	x	x
Is the development site next to or downstream / down slope of a canal?						x	x
Is the development site downstream/ down slope of a reservoir or other significant water body?						x	x
FURTHER COMMENT ON FLOOD RISK WITHIN THIS FRA?	✓	x	x	x	x	x	x

5.2 SOURCES OF FLOODING

It is considered that there are two potential sources of flooding to the site:

- Risk of flooding from watercourse located south of site boundary.
- Leakage of Canal due to site being positioned lower.

5.3 INFRASTRUCTURE FAILURE

The central CIRIA Report C624 defines ‘infrastructure failure’ as the structural, hydraulic, geotechnical, mechanical or operational failure of infrastructure which normally retains, transmits or controls the flow of water. This risk of flooding is usually associated with three main categories of infrastructure:

- failure of infrastructure designed to store or carry water (e.g. dam break, canal leak, water mains burst);
- failure of infrastructure designed to protect an area from flooding (e.g. flood defence breach, flap valve failure, penstock failure, pumping station failure);
- blockage of a pipe, bridge or culvert.

Failure of any water mains could result in leakage and consequently over-land flows within the site. There is therefore a risk of over-land flows being generated because of an infrastructure failure in any water mains, however, such failures occur very infrequently and there is little that can be done to anticipate them.

Water main failures are usually notified to the asset owner within a short period of time of the failure occurring and remedial Work is usually implemented soon thereafter to prevent subsequent property damage and inconvenience. Any failure of a water main is therefore likely to continue for a relatively short period of time.

Based on the above information, the risk of flooding as a result of infrastructure failure is considered to be low and on this basis any further assessment of flooding from infrastructure failure is not considered necessary.

5.4 RESIDUAL RISKS

Table 10.1 outlines the initial qualitative assessment of risk posed by each potential source of flooding, the mechanisms for flooding and the likely consequences. The table also includes a review of possible mitigation measures and what effect, if any, the mitigation measures are likely to have on the residual risk posed by each potential flood source.

Categories of risk have been qualitatively defined as:

‘High’ Risk: Flooding is likely to result in significant damage to property and pose a significant risk to life;
‘Medium’ Risk: Flooding is likely to result in possible minor damage to property but flood progress would allow adequate time for residents to be warned and safely evacuated to higher ground or appropriate places of safety;
‘Low’ Risk: Flooding is unlikely to result in any damage to property damage and pose little or no risk to life.

6 CLIMATE CHANGE

Below are the recommended rainfall intensity increases from the Flood Risk Assessment climate change allowances

Table 6.1 Peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline)

Applies across all of England	Total potential change anticipated for 2020s	Total potential change anticipated for 2050s	Total potential change anticipated for 2080s
Upper End	24%	43%	75%
Central	12%	19%	24%

For practical reasons, it is difficult to define the lifetime of a development as each development has different characteristics. However, residential development is considered to have a minimum lifetime horizon of 100 years, unless there is specific justification for considering a shorter period (e.g. development controlled by a time-limited Planning Condition). This development lifetime is approximately 100-year design life.

Therefore, over the next 100 years, the recommendations contained in table 2 Flood Risk assessments: climate change allowance document in terms of increased rainfall, would equate to an increase of between 43% and 75% in peak rainfall intensity.

A rainfall intensity of 75% has been used for designing this development. The preliminary design of the proposed SW drainage system has taken account of this increase in peak rainfall intensity over the lifetime of the proposed development and has demonstrated that surface water run-off can be managed in a sustainable manner on the site, including the effects of climate change. It is therefore considered that the proposed development has taken account of climate change effects.

7 CONCLUSIONS

MCI Developments are proposing a new residential development at the land of Trubs Farm, Thornton. Total area of the site is approximately 4.96ha.

The development site is greenfield and currently consists of an existing field.

The site lies within Flood Zone 1.

The site is overall at a low to medium risk from surface water flooding.

8 RECOMMENDATIONS

The installation of an effective drainage strategy will mitigate the risk of surface water and groundwater flooding on the site.

The Qbar rate is estimated to 28.5l/s.

APPENDIX A:

Introduction

1. This document provides additional guidance to local planning authorities to ensure the effective implementation of the planning policy set out in the National Planning Policy Framework on development in areas at risk of flooding and in relation to mineral extraction. This guidance retains key elements of Planning Policy Statement 25 and of the existing minerals policy statements and minerals planning guidance notes which are considered necessary and helpful in relation to these policy areas. The retention of this guidance is an interim measure pending a wider review of guidance to support planning policy.

Flood risk

2. As set out in the National Planning Policy Framework, inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere. For these purposes:
 - “areas at risk of flooding” means land within Flood Zones 2 and 3; or land within Flood Zone 1 which has critical drainage problems and which has been notified to the local planning authority by the Environment Agency;
 - “flood risk” means risk from all sources of flooding - including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

The Sequential and Exception Tests

3. As set out in the National Planning Policy Framework, the aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding. The flood zones (see table 1) are the starting point for this sequential approach. Zones 2 and 3 are shown on the flood map¹ with Flood Zone 1 being all the land falling outside Zones 2 and 3. These flood zones refer to the probability of sea and river flooding only, ignoring the presence of existing defences.
4. Strategic Flood Risk Assessments (see paragraphs 7-8) refine information on the probability of flooding, taking other sources of flooding and the impacts of climate change (see paragraphs 11-15) into account. They provide the basis for applying the Sequential Test, on the basis of the flood zones in table 1. Where table 1

¹ To access the flood map, see the Environment Agency's website at:
<http://www.environment-agency.gov.uk/homeandleisure/floods/default.aspx>

indicates the need to apply the Exception Test (as set out in the National Planning Policy Framework), the scope of a Strategic Flood Risk Assessment will be widened to consider the impact of the flood risk management infrastructure on the frequency, impact, speed of onset, depth and velocity of flooding within the flood zones considering a range of flood risk management maintenance scenarios. Where a Strategic Flood Risk Assessment is not available, the Sequential Test will be based on the Environment Agency flood zones.

5. The overall aim should be to steer new development to Flood Zone 1. Where there are no reasonably available sites in Flood Zone 1, local planning authorities allocating land in local plans or determining planning applications for development at any particular location should take into account the flood risk vulnerability of land uses (see table 2) and consider reasonably available sites in Flood Zone 2, applying the Exception Test if required (see table 3). Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 be considered, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required.

Table 1: Flood zones

(Note: These flood zones refer to the probability of river and sea flooding, ignoring the presence of defences)

Zone 1 - low probability Definition This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%). Appropriate uses All uses of land are appropriate in this zone. Flood risk assessment requirements For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in a flood risk assessment. This need only be brief unless the factors above or other local considerations require particular attention. Policy aims In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems².

² Sustainable drainage systems cover the whole range of sustainable approaches to surface drainage management. They are designed to control surface water run off close to where it falls and mimic natural drainage as closely as possible.

Zone 2 - medium probability

Definition

This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.

Appropriate uses

Essential infrastructure and the water-compatible, less vulnerable and more vulnerable uses, as set out in table 2, are appropriate in this zone. The highly vulnerable uses are *only* appropriate in this zone if the Exception Test is passed.

Flood risk assessment requirements

All development proposals in this zone should be accompanied by a flood risk assessment.

Policy aims

In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage systems.

Zone 3a - high probability

Definition

This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

Appropriate uses

The water-compatible and less vulnerable uses of land (table 2) are appropriate in this zone. The highly vulnerable uses should not be permitted in this zone.

The more vulnerable uses and essential infrastructure should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood.

Flood risk assessment requirements

All development proposals in this zone should be accompanied by a flood risk assessment.

Policy aims

In this zone, developers and local authorities should seek opportunities to:

- reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems;

- relocate existing development to land in zones with a lower probability of flooding; and
- create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.

Zone 3b - the functional floodplain

Definition

This zone comprises land where water *has* to flow or be stored in times of flood.

Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But land which would flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood in an extreme (0.1%) flood, should provide a starting point for consideration and discussions to identify the functional floodplain.

Appropriate uses

Only the water-compatible uses and the essential infrastructure listed in table 2 that has to be there should be permitted in this zone. It should be designed and constructed to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows; and
- not increase flood risk elsewhere.

Essential infrastructure in this zone should pass the Exception Test.

Flood risk assessment requirements

All development proposals in this zone should be accompanied by a flood risk assessment.

Policy aims

In this zone, developers and local authorities should seek opportunities to:

- reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems;
- relocate existing development to land with a lower probability of flooding.

Table 2: Flood risk vulnerability classification

Essential infrastructure • Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind turbines.
Highly vulnerable • Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use³. • Installations requiring hazardous substances consent⁴. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as “essential infrastructure”)⁵.
More vulnerable • Hospitals. • Residential institutions such as residential care homes, children’s homes, social services homes, prisons and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. • Non-residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste⁶. • Sites used for holiday or short-let caravans and camping, <i>subject to a specific warning and evacuation plan</i>.⁷
Less vulnerable • Police, ambulance and fire stations which are <i>not</i> required to be operational during flooding. • Buildings used for shops, financial, professional and other services,

³ For any proposal involving a change of use of land to a caravan, camping or chalet site, or to a mobile home site or park home site, the Sequential and Exception Tests should be applied.

⁴ See Circular 04/00: *Planning controls for hazardous substances* (paragraph 18) at: www.communities.gov.uk/publications/planningandbuilding/circularplanningcontrols

⁵ In considering any development proposal for such an installation, local planning authorities should have regard to planning policy on pollution in the National Planning Policy Framework.

⁶ For definition, see *Planning for Sustainable Waste Management: Companion Guide to Planning Policy Statement 10* at

www.communities.gov.uk/publications/planningandbuilding/planningsustainable

⁷ See footnote 3.

restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in “more vulnerable”, and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do <i>not</i> need to remain operational during times of flood. • Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).
Water-compatible development • Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel working. • Docks, marinas and wharves. • Navigation facilities. • Ministry of Defence defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, <i>subject to a specific warning and evacuation plan</i>.

Notes to table 2:

- This classification is based partly on Department for Environment, Food and Rural Affairs and Environment Agency research on *Flood Risks to People (FD2321/TR2)*⁸ and also on the need of some uses to keep functioning during flooding.
- Buildings that combine a mixture of uses should be placed into the higher of the relevant classes of flood risk sensitivity. Developments that allow uses to be distributed over the site may fall within several classes of flood risk sensitivity.
- The impact of a flood on the particular uses identified within this flood risk vulnerability classification will vary within each vulnerability class. Therefore, the flood risk management infrastructure and other risk mitigation measures needed to ensure the development is safe may differ between uses within a particular vulnerability classification.

⁸ See website for further details.

www.defra.gov.uk/science/Project_Data/DocumentLibrary/FD2320_3364_TRP.pdf

APPENDIX B:



REV	DATE	DRAWN	DESCRIPTION	ARCH. CHECK	ENG. CHECK
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TITLE
CONSTRAINTS AND HAZARD PLAN



PROJECT					
Trub Farm, Castleton Constraints Plan					
DRN BY	MM	SCALE	JOB REF	DRAWING NUMBER	REV
DATE	Dec '23	NTS @ A1	-	TRUB Constraints	-

APPENDIX C:

ELLUC Projects Ltd		Page 1
7 Regents Court Far Moor Lane Redditch B98 0SD		
Date 04/04/2024 15:17 File pond.SRCX	Designed by AlirezaAhmadi Checked by	
XP Solutions Source Control 2014.1.1		

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	4.640	Urban	0.000
SAAR (mm)	942	Region Number	Region 10

Results l/s

QBAR Rural	28.9
QBAR Urban	28.9
Q100 years	60.0
Q1 year	25.1
Q30 years	48.9
Q100 years	60.0

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APPENDIX D:

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<u>Summary of Results for 100 year Return Period (+40%)</u> Half Drain Time : 72 minutes. <table><thead><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr></thead><tbody><tr><td>15 min Summer</td><td>126.575</td><td>0.575</td><td>77.1</td><td>404.0</td><td>O K</td></tr><tr><td>30 min Summer</td><td>126.713</td><td>0.713</td><td>86.0</td><td>521.4</td><td>O K</td></tr><tr><td>60 min Summer</td><td>126.802</td><td>0.802</td><td>91.8</td><td>601.4</td><td>O K</td></tr><tr><td>120 min Summer</td><td>126.829</td><td>0.829</td><td>93.6</td><td>625.8</td><td>O K</td></tr><tr><td>180 min Summer</td><td>126.811</td><td>0.811</td><td>92.4</td><td>609.6</td><td>O K</td></tr><tr><td>240 min Summer</td><td>126.781</td><td>0.781</td><td>90.4</td><td>582.2</td><td>O K</td></tr><tr><td>360 min Summer</td><td>126.722</td><td>0.722</td><td>86.6</td><td>529.4</td><td>O K</td></tr><tr><td>480 min Summer</td><td>126.666</td><td>0.666</td><td>82.9</td><td>480.1</td><td>O K</td></tr><tr><td>600 min Summer</td><td>126.612</td><td>0.612</td><td>79.4</td><td>434.7</td><td>O K</td></tr><tr><td>720 min Summer</td><td>126.562</td><td>0.562</td><td>76.2</td><td>393.4</td><td>O K</td></tr><tr><td>960 min Summer</td><td>126.473</td><td>0.473</td><td>70.5</td><td>322.5</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>126.331</td><td>0.331</td><td>61.6</td><td>216.2</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>126.183</td><td>0.183</td><td>52.6</td><td>114.8</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>126.091</td><td>0.091</td><td>47.0</td><td>55.3</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>126.043</td><td>0.043</td><td>37.8</td><td>25.6</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>126.034</td><td>0.034</td><td>30.1</td><td>20.6</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>126.029</td><td>0.029</td><td>25.6</td><td>17.3</td><td>O 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Summer</td><td>7.135</td><td>0.0</td><td>548</td></tr><tr><td>1440 min Summer</td><td>5.230</td><td>0.0</td><td>794</td></tr><tr><td>2160 min Summer</td><td>3.824</td><td>0.0</td><td>1148</td></tr><tr><td>2880 min Summer</td><td>3.058</td><td>0.0</td><td>1500</td></tr><tr><td>4320 min Summer</td><td>2.227</td><td>0.0</td><td>2200</td></tr><tr><td>5760 min Summer</td><td>1.776</td><td>0.0</td><td>2936</td></tr><tr><td>7200 min Summer</td><td>1.491</td><td>0.0</td><td>3568</td></tr><tr><td>8640 min Summer</td><td>1.293</td><td>0.0</td><td>4280</td></tr></tbody></table>						Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	15 min Summer	126.575	0.575	77.1	404.0	O K	30 min Summer	126.713	0.713	86.0	521.4	O K	60 min Summer	126.802	0.802	91.8	601.4	O K	120 min Summer	126.829	0.829	93.6	625.8	O K	180 min Summer	126.811	0.811	92.4	609.6	O K	240 min Summer	126.781	0.781	90.4	582.2	O K	360 min Summer	126.722	0.722	86.6	529.4	O K	480 min 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360 min Summer	14.978	0.0	228																																																																																																																																																																																																
480 min Summer	12.069	0.0	294																																																																																																																																																																																																
600 min Summer	10.199	0.0	360																																																																																																																																																																																																
720 min Summer	8.883	0.0	424																																																																																																																																																																																																
960 min Summer	7.135	0.0	548																																																																																																																																																																																																
1440 min Summer	5.230	0.0	794																																																																																																																																																																																																
2160 min Summer	3.824	0.0	1148																																																																																																																																																																																																
2880 min Summer	3.058	0.0	1500																																																																																																																																																																																																
4320 min Summer	2.227	0.0	2200																																																																																																																																																																																																
5760 min Summer	1.776	0.0	2936																																																																																																																																																																																																
7200 min Summer	1.491	0.0	3568																																																																																																																																																																																																
8640 min Summer	1.293	0.0	4280																																																																																																																																																																																																
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ELLUC Projects Ltd				Page 2	
7 Regents Court Far Moor Lane Redditch B98 OSD					
Date 09/04/2024 14:04 File POND.SRCX		Designed by AlirezaAhmadi Checked by			
XP Solutions		Source Control 2014.1.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Summer	126.023	0.023	19.8	13.5	O K
15 min Winter	126.639	0.639	81.2	457.5	O K
30 min Winter	126.793	0.793	91.2	593.1	O K
60 min Winter	126.898	0.898	98.1	691.3	O K
120 min Winter	126.924	0.924	99.9	717.0	O K
180 min Winter	126.897	0.897	98.1	690.6	O K
240 min Winter	126.852	0.852	95.1	647.6	O K
360 min Winter	126.763	0.763	89.2	565.6	O K
480 min Winter	126.679	0.679	83.8	491.9	O K
600 min Winter	126.602	0.602	78.8	426.6	O K
720 min Winter	126.532	0.532	74.3	369.5	O K
960 min Winter	126.411	0.411	66.7	275.6	O K
1440 min Winter	126.230	0.230	55.4	145.9	O K
2160 min Winter	126.065	0.065	45.4	39.2	O K
2880 min Winter	126.043	0.043	37.8	25.5	O K
4320 min Winter	126.031	0.031	27.4	18.6	O K
5760 min Winter	126.025	0.025	22.1	15.0	O K
7200 min Winter	126.021	0.021	18.5	12.6	O K
8640 min Winter	126.018	0.018	15.9	10.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
10080 min Summer	1.146	0.0	5080		
15 min Winter	122.608	0.0	23		
30 min Winter	83.086	0.0	35		
60 min Winter	53.779	0.0	60		
120 min Winter	33.599	0.0	98		
180 min Winter	25.120	0.0	136		
240 min Winter	20.279	0.0	172		
360 min Winter	14.978	0.0	244		
480 min Winter	12.069	0.0	314		
600 min Winter	10.199	0.0	380		
720 min Winter	8.883	0.0	446		
960 min Winter	7.135	0.0	572		
1440 min Winter	5.230	0.0	814		
2160 min Winter	3.824	0.0	1144		
2880 min Winter	3.058	0.0	1452		
4320 min Winter	2.227	0.0	2152		
5760 min Winter	1.776	0.0	2864		
7200 min Winter	1.491	0.0	3624		
8640 min Winter	1.293	0.0	4408		
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7 Regents Court Far Moor Lane Redditch B98 0SD																								
Date 09/04/2024 14:04		Designed by AlirezaAhmadi																						
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XP Solutions		Source Control 2014.1.1																						
<u>Summary of Results for 100 year Return Period (+40%)</u> <table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>10080 min Winter</td><td>126.016</td><td>0.016</td><td>14.1</td><td>9.7</td><td>O K</td></tr></table> <table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>10080 min Winter</td><td>1.146</td><td>0.0</td><td>5040</td></tr></table>					Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	10080 min Winter	126.016	0.016	14.1	9.7	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)	10080 min Winter	1.146	0.0	5040
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status																			
10080 min Winter	126.016	0.016	14.1	9.7	O K																			
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)																					
10080 min Winter	1.146	0.0	5040																					
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ELLUC Projects Ltd		Page 4
7 Regents Court Far Moor Lane Redditch B98 0SD		
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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.334	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.080

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To: (ha)	From:	To: (ha)	From:	To: (ha)
0	4 0.693	4	8 0.693	8	12 0.693

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7 Regents Court Far Moor Lane Redditch B98 0SD		
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Model Details

Storage is Online Cover Level (m) 128.000

Infiltration Basin Structure

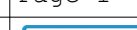
Invert Level (m) 126.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.50500 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.50500

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	592.0	2.000	1541.0

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APPENDIX E:



ELLUC Projects Ltd		Page 1
7 Regents Court Far Moor Lane Redditch B98 0SD		
Date 09/04/2024 14:03 File STORM.MDX	Designed by AlirezaAhmadi Checked by	
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Network Design Table for STORM.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
1.002	54.705	0.199	274.9	0.139	0.00		0.0 0.600	o	450	
1.003	57.034	0.173	329.7	0.200	0.00		0.0 0.600	o	450	
1.004	49.405	0.365	135.4	0.340	0.00		0.0 0.600	o	525	
2.000	66.495	1.085	61.3	0.100	5.00		0.0 0.600	o	225	
1.005	63.054	0.197	320.1	0.392	0.00		0.0 0.600	o	525	
1.006	26.529	0.243	109.2	0.000	0.00		0.0 0.600	o	525	
3.000	45.682	1.150	39.7	0.100	5.00		0.0 0.600	o	150	
1.007	61.337	0.170	360.8	0.512	0.00		0.0 0.600	o	600	
1.008	47.907	0.120	399.2	0.000	0.00		0.0 0.600	o	600	
1.009	49.134	0.249	197.3	0.000	0.00		0.0 0.600	o	600	
4.000	19.552	0.065	300.8	0.000	5.00		0.0 0.600	o	600	
1.010	40.228	0.134	300.0	0.000	0.00		0.0 0.600	o	600	
1.011	1.000#	0.004	250.0	0.000	0.00		0.0 0.600	o	600	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.002	77.32	7.14	128.102	0.439	0.0	0.0	0.0	1.22	194.2	91.9
1.003	73.12	7.99	127.903	0.639	0.0	0.0	0.0	1.11	177.2	126.5
1.004	71.20	8.42	127.655	0.979	0.0	0.0	0.0	1.92	416.4	188.8
2.000	86.12	5.66	128.600	0.100	0.0	0.0	0.0	1.67	66.5	23.3
1.005	67.75	9.27	127.215	1.471	0.0	0.0	0.0	1.25	269.8	269.9
1.006	66.96	9.47	127.018	1.471	0.0	0.0	0.0	2.14	464.0	269.9
3.000	87.40	5.48	128.300	0.100	0.0	0.0	0.0	1.60	28.3	23.7
1.007	64.09	10.27	126.700	2.083	0.0	0.0	0.0	1.28	360.8	361.5
1.008	61.93	10.93	126.530	2.083	0.0	0.0	0.0	1.21	342.8	361.5
1.009	60.49	11.40	126.410	2.083	0.0	0.0	0.0	1.73	489.2	361.5
4.000	89.13	5.23	126.000	0.000	0.0	0.0	0.0	1.40	395.5	0.0
1.010	59.10	11.88	125.935	2.083	0.0	0.0	0.0	1.40	396.0	361.5
1.011	59.07	11.89	127.850	2.083	0.0	0.0	0.0	1.54	434.2	361.5

ELLUC Projects Ltd										Page 2	
7 Regents Court Far Moor Lane Redditch B98 0SD											
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<u>Manhole Schedules for STORM.SWS</u>											
MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
1	130.300	1.500	Open Manhole	1200	1.000	128.800	300				
2	132.000	3.568	Open Manhole	1200	1.001	128.432	375	1.000	128.507	300	
3	132.236	4.134	Open Manhole	1200	1.002	128.102	450	1.001	128.177	375	
4	129.700	1.797	Open Manhole	1200	1.003	127.903	450	1.002	127.903	450	
5	129.450	1.795	Open Manhole	1200	1.004	127.655	525	1.003	127.730	450	
14	130.200	1.600	Open Manhole	1200	2.000	128.600	225				
6	129.300	2.085	Open Manhole	1200	1.005	127.215	525	1.004	127.290	525	75
								2.000	127.515	225	
16	129.000	1.982	Open Manhole	1200	1.006	127.018	525	1.005	127.018	525	
15	129.800	1.500	Open Manhole	1200	3.000	128.300	150				
7	128.600	1.900	Open Manhole	1200	1.007	126.700	600	1.006	126.775	525	
								3.000	127.150	150	
11	128.600	2.070	Open Manhole	1500	1.008	126.530	600	1.007	126.530	600	
12	128.900	2.490	Open Manhole	1200	1.009	126.410	600	1.008	126.410	600	
17	128.150	2.150	Open Manhole	1500	4.000	126.000	600				
14	128.700	2.765	Open Manhole	1500	1.010	125.935	600	1.009	126.161	600	226
								4.000	125.935	600	
13	128.700	2.899	Open Manhole	1500	1.011	127.850	600	1.010	125.801	600	
outfall	128.935	1.089	Open Manhole	0		OUTFALL		1.011	127.846	600	
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**Micro
Drainage**

ELLUC Projects Ltd		Page 5
7 Regents Court Far Moor Lane Redditch B98 0SD		
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Synthetic Rainfall Details Storm Duration (mins) 30		
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Page 7

7 Regents Court

Far Moor Lane

Redditch B98 0SD

Date 09/04/2024 14:03

File STORM.MDX

Designed by AlirezaAhmadi

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XP Solutions

Network 2014.1.1

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

for STORM.SWS

Simulation Criteria

Areal Reduction Factor 1.000

Additional Flow - % of Total Flow 0.000

Hot Start (mins) 0

MADD Factor * 10m³/ha Storage 2.000

Hot Start Level (mm) 0

Inlet Coefficient 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 1

Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR

Ratio R 0.345

Region England and Wales Cv (Summer) 0.750

M5-60 (mm) 19.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0

Analysis Timestep 2.5 Second Increment (Extended)

DTS Status ON

DVD Status ON

Inertia Status ON

Profile(s) Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 5760, 7200, 8640, 10080

Return Period(s) (years) 100

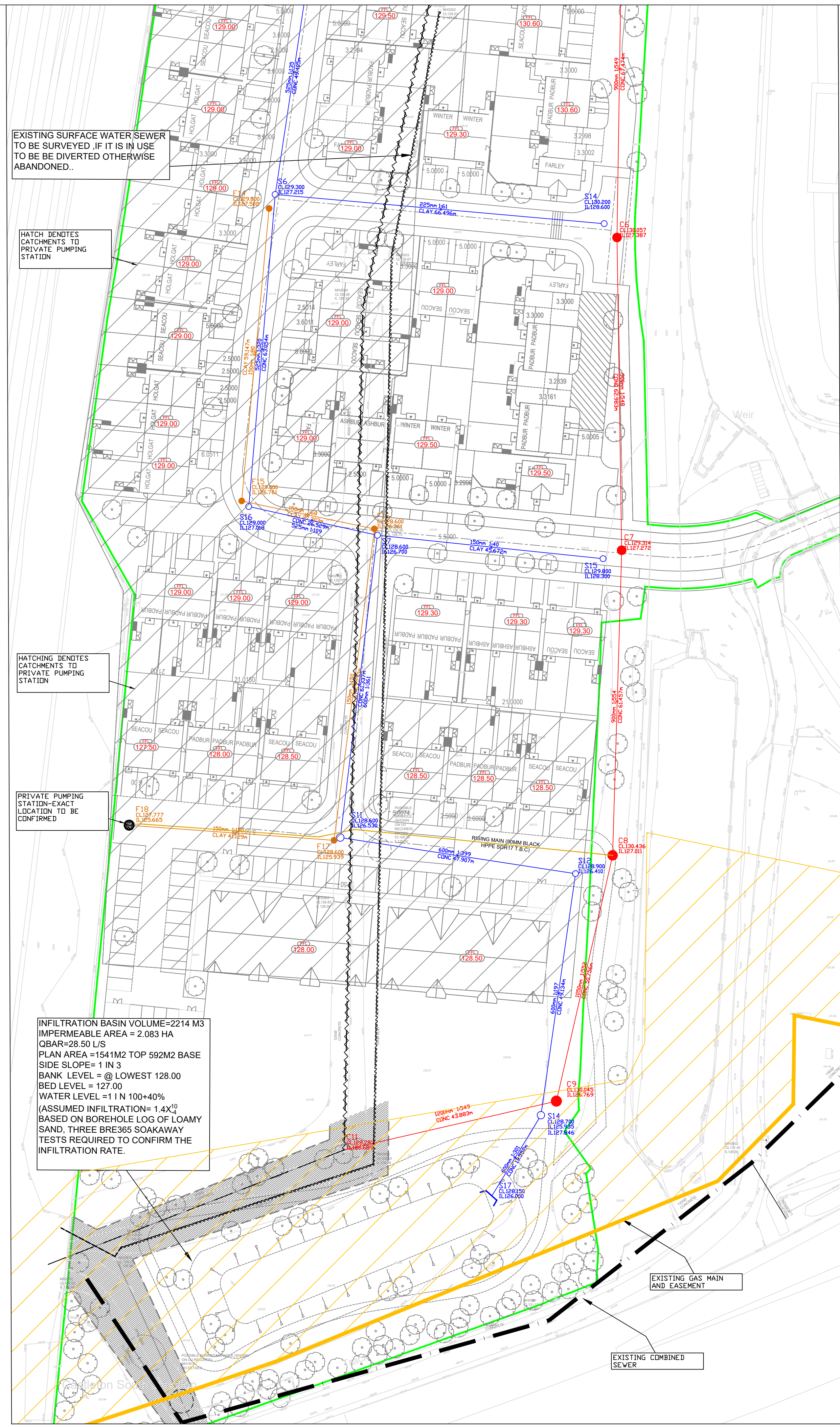
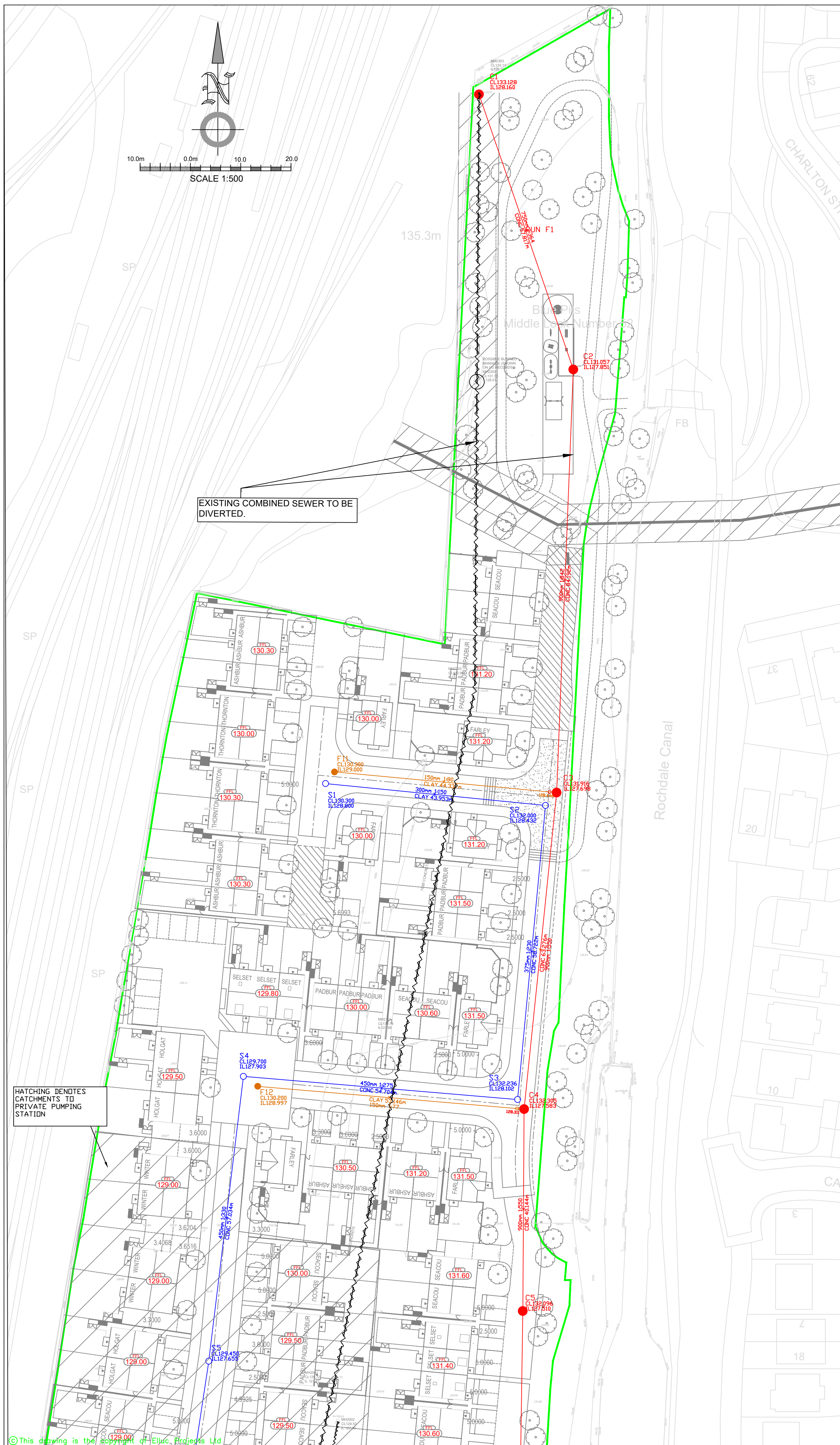
Climate Change (%) 40

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	100	+40%	100/15 Summer	100/15 Summer			2
1.001	15 Winter	100	+40%	100/15 Summer				
1.002	15 Winter	100	+40%	100/15 Summer				
1.003	15 Winter	100	+40%	100/15 Summer	100/15 Summer			4
1.004	15 Winter	100	+40%	100/15 Summer	100/15 Summer			4
2.000	15 Winter	100	+40%	100/15 Summer				
1.005	15 Winter	100	+40%	100/15 Summer	100/15 Summer			4
1.006	15 Winter	100	+40%	100/15 Summer				
3.000	15 Winter	100	+40%	100/15 Summer	100/15 Summer			4
1.007	15 Winter	100	+40%	100/15 Summer	100/15 Winter			1
1.008	15 Winter	100	+40%	100/15 Summer				
1.009	120 Winter	100	+40%	100/15 Summer				
4.000	120 Winter	100	+40%	100/15 Winter				
1.010	120 Winter	100	+40%	100/15 Summer				
1.011	120 Winter	100	+40%					

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7 Regents Court Far Moor Lane Redditch B98 0SD																																																																																		
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<u>User Report C:\Users\AlirezaAhmadi\Downloads\volume calcs.SPDX for STORM.SWS</u>																																																																																		
<table><thead><tr><th>USMH</th><th>USMH Dia (mm)</th><th>US MH Depth (m)</th><th>Dia (mm)</th><th>Length (m)</th></tr></thead><tbody><tr><td>1</td><td>1200</td><td>1.500</td><td>300</td><td>43.954</td></tr><tr><td>2</td><td>1200</td><td>3.568</td><td>375</td><td>58.722</td></tr><tr><td>3</td><td>1200</td><td>4.134</td><td>450</td><td>54.705</td></tr><tr><td>4</td><td>1200</td><td>1.797</td><td>450</td><td>57.034</td></tr><tr><td>5</td><td>1200</td><td>1.795</td><td>525</td><td>49.405</td></tr><tr><td>14</td><td>1200</td><td>1.600</td><td>225</td><td>66.495</td></tr><tr><td>6</td><td>1200</td><td>2.085</td><td>525</td><td>63.054</td></tr><tr><td>16</td><td>1200</td><td>1.982</td><td>525</td><td>26.529</td></tr><tr><td>15</td><td>1200</td><td>1.500</td><td>150</td><td>45.682</td></tr><tr><td>7</td><td>1200</td><td>1.900</td><td>600</td><td>61.337</td></tr><tr><td>11</td><td>1500</td><td>2.070</td><td>600</td><td>47.907</td></tr><tr><td>12</td><td>1200</td><td>2.490</td><td>600</td><td>49.134</td></tr><tr><td>17</td><td>1500</td><td>2.150</td><td>600</td><td>19.552</td></tr><tr><td>14</td><td>1500</td><td>2.765</td><td>600</td><td>40.228</td></tr><tr><td>13</td><td>1500</td><td>2.899</td><td>600</td><td>1.000 #</td></tr></tbody></table>			USMH	USMH Dia (mm)	US MH Depth (m)	Dia (mm)	Length (m)	1	1200	1.500	300	43.954	2	1200	3.568	375	58.722	3	1200	4.134	450	54.705	4	1200	1.797	450	57.034	5	1200	1.795	525	49.405	14	1200	1.600	225	66.495	6	1200	2.085	525	63.054	16	1200	1.982	525	26.529	15	1200	1.500	150	45.682	7	1200	1.900	600	61.337	11	1500	2.070	600	47.907	12	1200	2.490	600	49.134	17	1500	2.150	600	19.552	14	1500	2.765	600	40.228	13	1500	2.899	600	1.000 #
USMH	USMH Dia (mm)	US MH Depth (m)	Dia (mm)	Length (m)																																																																														
1	1200	1.500	300	43.954																																																																														
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7	1200	1.900	600	61.337																																																																														
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14	1500	2.765	600	40.228																																																																														
13	1500	2.899	600	1.000 #																																																																														
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APPENDIX F:



- NOTES:**
1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
 2. DO NOT SCALE THIS DRAWING. ALL DETAILS AND DIMENSIONS ARE TO BE CHECKED BY THE CONTRACTOR PRIOR TO COMMENCEMENT OF CONSTRUCTION. ANY DISCREPANCIES TO BE REPORTED TO THE ENGINEER.
 3. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE
 4. ALL LEVELS ARE RELEVANT TO ORDNANCE DATUM (NEWLY.N).
 5. LOCATION OF EXISTING SEWERS, UTILITIES AND SERVICES TO BE SURVEYED BEFORE COMMENCING WORK ON SITE.
 6. ALL ADAPTABLE SEWER WORKS AND MATERIAL TO BE IN ACCORDANCE WITH "SEWERS FOR ADOPTION" 6TH EDITION, THE RELEVANT "BRITISH EUROPEAN AND UNITED UTILITIES' STANDARDS/REQUIREMENTS/ADDENDUM TO THE MECHANICAL AND ELECTRICAL SPECIFICATION AND KITEMARKED".
 7. MANHOLE COVERS SHALL MUST HAVE A CLEAR OPENING OF 600mm AND MUST BE CLASS D400 TO BS EN 124 WITH 150mm DEEP FRAMES IN HIGHWAYS.
 8. FILLED GROUND MUST BE FILLED AND CONSOLIDATED UNDER THE SURVEILLANCE AND TO THE SATISFACTION OF UNITED UTILITIES BEFORE ANY SEWER WORKS ARE CARRIED OUT.
 9. UNITED UTILITIES IS NOT OBLIGED TO ACCEPT FILTER DRAIN/LAND DRAINAGE RUN-OFF INTO THE PUBLIC SEWER NETWORK OR ADAPTABLE DRAINAGE SYSTEM (DIRECTLY OR INDIRECTLY). AN ALTERNATIVE METHOD OF DISPOSAL OF THE LAND DRAINAGE RUN-OFF WILL THEREFORE BE REQUIRED AND YOU WILL HAVE TO LIASE WITH THE LOCAL AUTHORITY. LAND DRAINAGE SECTION WITH REGARD TO THE DISPOSAL OF THE FILTER DRAIN/LAND DRAINAGE RUN-OFF.
 10. COVER SLABS MUST CARRY THE BSI KITEMARK OR WILL BE REJECTED BY UNITED UTILITIES INSPECTOR. WHERE THE CLEAR OPENING OF THE KITEMARKED PRODUCT IS DIFFERENT TO THAT OF THE COVER AND FRAME, A LOADING BEARING SLAB SHOULD BE FITTED ABOVE THE COVER SLAB TO BRING THE SIZE DOWN TO 600mm x 600mm FOR THE UNITED UTILITIES SPECIFIED COVER SIZE. PLEASE REFER TO CONCRETE PIPE SYSTEMS ADDENDUM (CPA) COVER SLAB LITELLITE ISSUE DATE AUTUMN 2004 FOR KITE MARKED COVER SLAB OPENING SIZES.
 11. SULPHATE RESISTANT CEMENT (C20.02) AND PRECAST CONCRETE PRODUCTS MUST BE USED OR A LABORATORY REPORT PROVIDED PROVING THAT SUCH PRECAUTIONS ARE NOT NECESSARY.
 12. THE ADAPTABLE SEWERS SHOULD BE A MINIMUM OF 1m AND MANHOLES 0.5m FROM KERB FACES AND SERVICE MARGINS.
 13. "SEWERS MUST HAVE A 5 METRES CLEARANCE FROM TREES AND HEDGES. PLEASE ALSO REFER TO FIGURE 2.0 ON PAGE 32 IN "SEWERS FOR ADOPTION" 6TH EDITION FOR RESTRICTIONS ON TREE PLANTING ADJACENT TO SEWERS".
 14. SEWERS TO BE LAID IN CLASS "S" BEDDING (150mm GRANULAR BED AND SURROUND), WHERE DEPTH OF COVER TO TOP OF THE SEWER IS LESS THAN 1.2M IN HIGHWAYS AND VERGES (OR LESS THAN 900MM IN NONE HIGHWAY ACCESS). THEN A CONCRETE SLAB SHOULD BE PROVIDED ABOVE GRANULAR BED AND SURROUND.
 15. BEDDING AND BACKFILL MATERIAL, TO CONFORM TO THE REQUIREMENT OF WATER INDUSTRY SPECIFICATION 4-08-02 (TABLE A2).
 16. THE CHAMBER SIZE OF MANHOLES WITH MORE THAN ONE CONNECTION IN THEM MAY NEED TO BE INCREASED AN INCREMENT TO ACCOMMODATE THE CONNECTIONS AND BENEFITS.
 17. UNITED UTILITIES POLICY IS NOT TO ACCEPT TYPE "C" BRICK MANHOLES AND 150mm DIA MANHOLE RINGS. INSTEAD IT IS PREFERRED THAT YOU USE A TYPE "B" MANHOLE WITH 1200mm DIA OR 150mm DIA RINGS, WITH THE OPENING STITCH OVER THE CHANNEL. WHERE DEPTH OF COVER TO PIPE SLOTT IS 1.1 - 1.5m.
 18. "THE MINIMUM CRUSHING STRENGTH FOR CLAY PIPES SHOULD BE AS FOLLOWS: 100mm DIA, 400kN/m; 150mm DIA, 400kN/m; 225mm DIA, 450kN/m; 300mm DIA, 720kN/m.
 19. THE MINIMUM CRUSHING STRENGTH FOR CONCRETE PIPES SHOULD BE TO CLASS 120 TO EN 1916 / BS 5911-1:2002".
 19. PRIVATE DRAINAGE SHOWN ON THIS DRAWING FOR INFORMATION. REFER TO APPROPRIATE ELLUC PROJECTS DRAWINGS FOR CURRENT LAYOUTS AND ADDITIONAL INFORMATION.
 20. INVERT AND COVER LEVELS OF EXISTING MANHOLE TO BE CONFIRMED PRIOR TO WORKS COMMENCING ON SITE.

LEGEND

-  Proposed S104 Surface water sewer
-  Proposed S104 Foul water sewer
-  Proposed S185 Proposed diverted public sewer
-  Existing Combined Sewer
-  Existing Combined Sewer to be Abandoned
-  Site Boundary
-  Sewer Easement

Rev:	Description:	Date:	By:	Chkd:
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CONCEPT

MCI DEVELOPMENTS

Project: TRUB FARM
ROCHDALE

CONCEPT DRAINAGE LAYOUT



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