

Greenhead College

Drainage Strategy

Galliford Try

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Executive Summary

Cundall have prepared this Drainage Strategy as part of the planning submission for the proposed development at Greenhead College, Greenhead Road, Huddersfield.

Cundall have submitted a pre-planning enquiry to Yorkshire Water regarding the disposal of foul and surface water. Foul water flows are permitted to the 450mm sewer in Greenhead Road. Surface water must be restricted to 30% existing flows and should discharge to similar points of connection as existing.

An existing network model has been created and shows there is 43m³ of flooding during the 1 in 100 year event + 30% climate change. This is due to the original site not being designed with modern climate change factor design criteria. The proposed drainage strategy reduces the flooding in the existing network to 3m³ which reduces the flood risk for the overall site.

The drainage system will be designed to ensure no overland flooding in the proposed network for all events up to and including the 100-year design storm (+ 30% climate change). The proposed discharge from the development has been set at 149l/s (30% betterment to existing brownfield flows).

There are no net changes in foul water flows from the site.

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1.0

Introduction

1.0 Introduction

1.1 Reason for Report and Planning Context

Cundall have prepared this Drainage Strategy (DS) to accompany the planning application for the proposed redevelopment of Greenhead College in Huddersfield.

1.2 Scope of Report

This report has been written to meet the requirements of a site-specific DS in accordance with the National Planning Policy Framework (NPPF) and includes the following:

- An appraisal of the existing site and its current drainage pattern
- Surface water drainage proposals
- Foul water drainage proposals

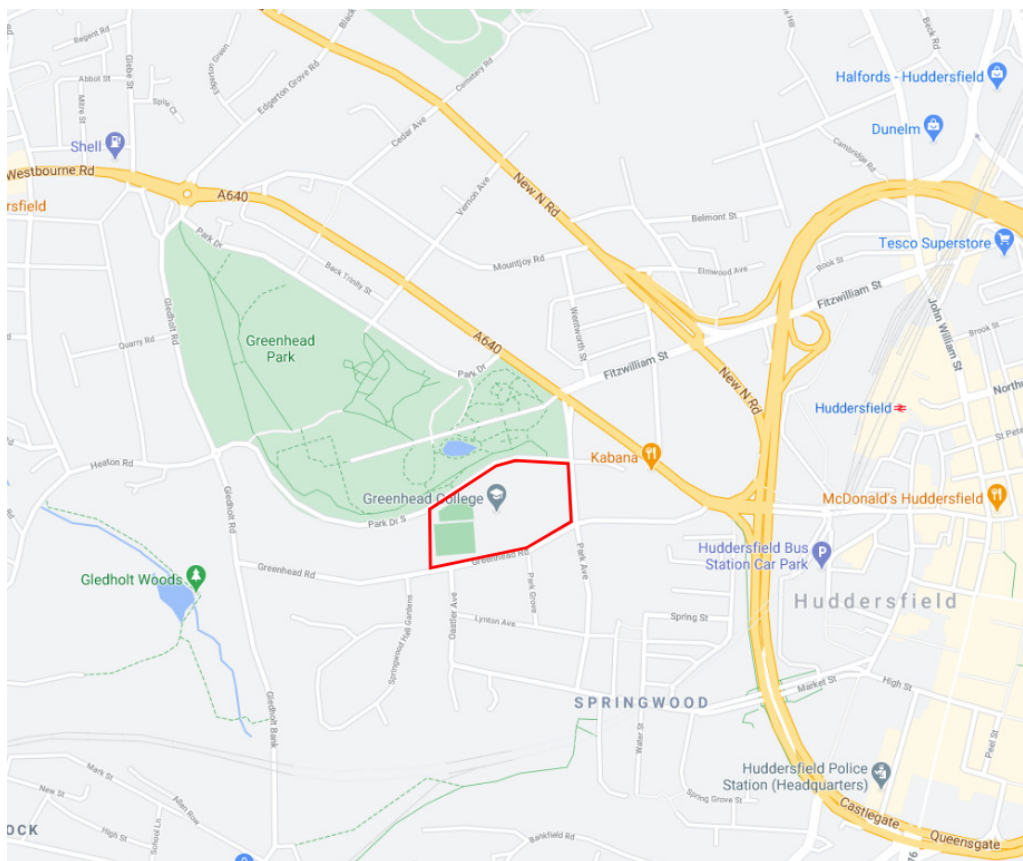


Figure 1: Site location (Source: Google Maps)

2.0 The Site

2.1 Site Description

The site is located within the jurisdiction of Kirklees Council, to the west of Huddersfield centre. The approximate National Grid Reference SE 13735 16738 and the postcode is HD1 4ES. A site location plan can be seen in Figure 1. It has an area of approximately 2.5 hectares and slopes generally from the west to east with levels from 132m to 122m with a retaining wall running the length of the site to the east of the all weather pitch. The Topographical Survey is shown in Appendix 1. The site is currently in use as Greenhead College , with the main built form at the centre of the site spanning from north to south. To the east there is an additional block and car park, to the west there is sport provision including an all weather pitch and changing facilities.

2.1.1 Surrounding area

The site is bound by streets to the north, east and south and housing to the west. North of the site lies Greenhead Park, which is a large park consisting of open greenery, mature trees and various water features. The other three sides of the site are residential developments. The nearest Main River, according to the Environment Agency Classification, is the River Colne which lies 550m south of the site. The elevation of the river is approximately 50m lower than the site.

2.2 Proposed Development

2.2.1 Development

The proposed development is to demolish part of the existing central building and replace it with new accommodation. The new block is a four-story building located on the existing car park located to the east of the site. At the centre of the development, in place of the demolished building, there will be a small infill building (referred to as the infill area from here on in). The proposed development can be seen in Figure 2 (Appendix 2).



Figure 2: Proposed Development (Source: Oobe Site Plan)

2.3 Flood Risk

All forms of flood risk posed to the site and the potential impact of development on flood risk elsewhere has been assessed as low. Flood Risk is covered in the separate document Flood Risk Assessment, reference NE8659-CCS-ZZ-XX-RT-D-0001, which accompanies this report as part of the planning submission.

2.4 Consultations

2.4.1 Kriklees – Lead Local Flood Authority (LLFA)

At the pre application stage the LLFA gave some comments on an early design of the site. Key points include:

- The site lies in a Flood Zone 1
- No historic flooding has been recorded in or near the site
- Critical 1 in 30 year storm must be attenuated
- Volume generated by storm up to 1 in 100 + 30% climate change must be stored on site
- A 30% betterment of the current discharge rate needs to be provided.

Further comments were received on the 27/10/21:

- The simulated maximum water levels in the MHs for the critical 1 in 100-year storm (plus 30% CC) are not provided in the calculations.
- The volume of flooding (if any) produced by the critical storm is not shown in the calculations.
- The rating and size of the hydrobrake on the outlet from the storage tank (SW08) is not indicated.
- The PN numbers in the calculations are not indicated on the drainage plan making cross-referencing very difficult.
- The calculations indicate several hydrobrakes with outlet diameters less than the acceptable diameter of 75 mm – these small diameter outlets will be prone to blockage and should be avoided.
- The outlet from MH SW 24 connects to the YW sewer in Greenhead Road without any apparent attenuation. (Note that the flow through this MH can discharge at an unattenuated rate provided a compensatory reduction is made to the main outlet to the sewer in Park Drive South).
- Exceedance flood routing plan.

More comments were received on the 30/10/21:

- Clarification with regards to performance of Existing Manhole no.13 and the existing connection to Park Drive South
- A Catchpit style sump should be included in SW 07 to reduce sedimentation in the tank
- It is recommended that the geocell tank has a low flow channel/pipe at its invert to allow first flush flows to pass directly through the tank. These comments have been addressed in this report.

These comments have been incorporated into the design.

2.4.2 Environment Agency

The Environment Agency have not been directly consulted as there was no flood risk identified from relevant sources and discharge is not to watercourse, however their flood maps have been used extensively throughout this report.

2.4.3 Sewerage Undertaker

Cundall have submitted a pre-planning enquiry to Yorkshire Water (YW) regarding the disposal of foul and surface water. Foul water flows are permitted to the 450mm sewer in Greenhead Road. Surface water must be restricted to a reduction of 30% on existing flows and should discharge to similar points of connection as existing. Furthermore, YW have also provided existing sewer records for site review. The pre-planning enquiry response has been included in Appendix 3.

Further comments were received on the 02/11/21 relating to the way the discharge rate has been calculated. Discussions are currently on-going.

3.0 Existing Drainage

3.1 Public Sewerage System

Existing YW sewer records have been acquired for the site to assess development impacts on infrastructure and potential connection locations, they can be seen in Appendix 4. YW assets are located in Park Drive South, Park Avenue and Greenhead Road.

3.2 Private Drainage

An initial CCTV survey was undertaken on the 20.10.20. The survey shows that all drainage associated the main building is combined and drainage of the newer Rostron building and changing block are separate foul and surface water networks. At present there are 4 combined sewer connections to the Yorkshire Water network, two in Park Drive South and two in Greenhead Road. Further to this there are two soakaways on-site, one for the Rostron building to the North East and the other for the astro-turf pitch to the South West.

There are multiple impermeable areas across the development that have no visible positive drainage. The largest of these is the existing car park (where the new building has been proposed) with an area of approximately 0.2ha. There is a suspected overland flow route though the pedestrian entrance at the southeast of the college on to Greenhead Road. The peak overland flow from this area has been estimated at 32l/s using the modified rational method.

There are multiple locations in the existing network where manhole cover levels and invert levels do not match the topography and they should be surveyed before works commence on site. Evidence of this discrepancy can be seen on the CCTV survey in Appendix 5.

High Pressure Jetting and a further CCTV survey was undertaken on the 08.04.21. This survey found multiple cracks in pipes and high levels of rooting. It is recommended that these runs be or refurbished or diverted as part of the works.

4.0 Proposed Drainage Strategy

4.1 Drainage Design General

All new drainage for the development will be designed and installed in accordance with the following British Standards and codes of practice and building control documents.

- BS EN 752 – Drain and Sewer Systems Outside Buildings
- Building Regulations Part H – Drainage and waste disposal

The new drainage pipelines will be constructed from a combination/choice of UPVC, cast iron (ductile), vitrified clay and concrete. Manhole construction associated with the drainage network will be constructed from UPVC pre-formed inspection chambers, engineering brickwork or pre-cast concrete sections, depending on the depth and size of the chamber.

A CCTV survey of the drainage must be carried out on completion of the works to ensure the system is adequately constructed and provides an effective disposal system.

4.2 Surface Water Discharge & Hierarchy

Building Regulations Approved Document H gives a hierarchy of how surface water should be disposed of as shown in Figure 3. Firstly, surface water should be discharged into the ground. If this is not reasonably practicable, to a watercourse and where this is not reasonably practicable, to a surface water sewer and as a last resort, a combined sewer. The following sections work through that hierarchy.

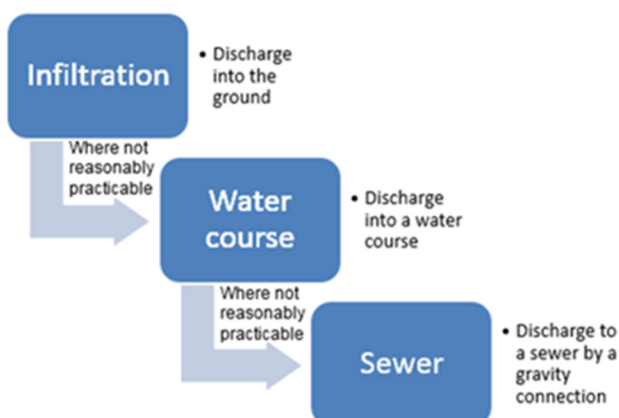


Figure 3: The surface water discharge hierarchy

Infiltration

Infiltration has been used on site in two locations. These two existing soakaways shall be retained as part of the proposed development and their infiltration rates confirmed prior to construction. Soakaway testing has been conducted in line with BRE365 and found the permeability to be between $1.6 \times 10^{-6} \text{m/s}$ to $7 \times 10^{-7} \text{m/s}$. Two falling head tests were conducted alongside the BRE365 tests and permeability from the test was $3.5 \times 10^{-6} \text{m/s}$ and $3.3 \times 10^{-9} \text{m/s}$. On top of this the water table at the west of the site is high, limiting the potential for infiltration. Therefore in line with the SuDS Manual it is not deemed as acceptable to provide new infiltration points within the site other than those that currently exist.

Water Course

The site is over 300m away from the nearest watercourse and there is no opportunity to connect directly to an existing water course. Thus, without a watercourse within a practicable proximity to discharge to it is proposed that the surface water runoff from the site will be discharged into a local sewer by a gravity connection.

Sewer

Discharging from the site through infiltration or to an existing water course have not been deemed viable options. Therefore, the proposed surface water runoff from the site will be discharged via existing connections to YW sewers. Two connections are north of the site to the sewer under Park Drive South and another two are to the south connection to the sewer under Greenhead Road.

Strategy

All surface water shall be treated where required in accordance with the SuDS Manual. The majority of new hard standing areas (shown in Figure 4) are to be made of permeable paving to provide both attenuation and water treatment. The new building will be fitted with a green roof to provide treatment which shall be connected to a geocellular tank to provide attenuation.

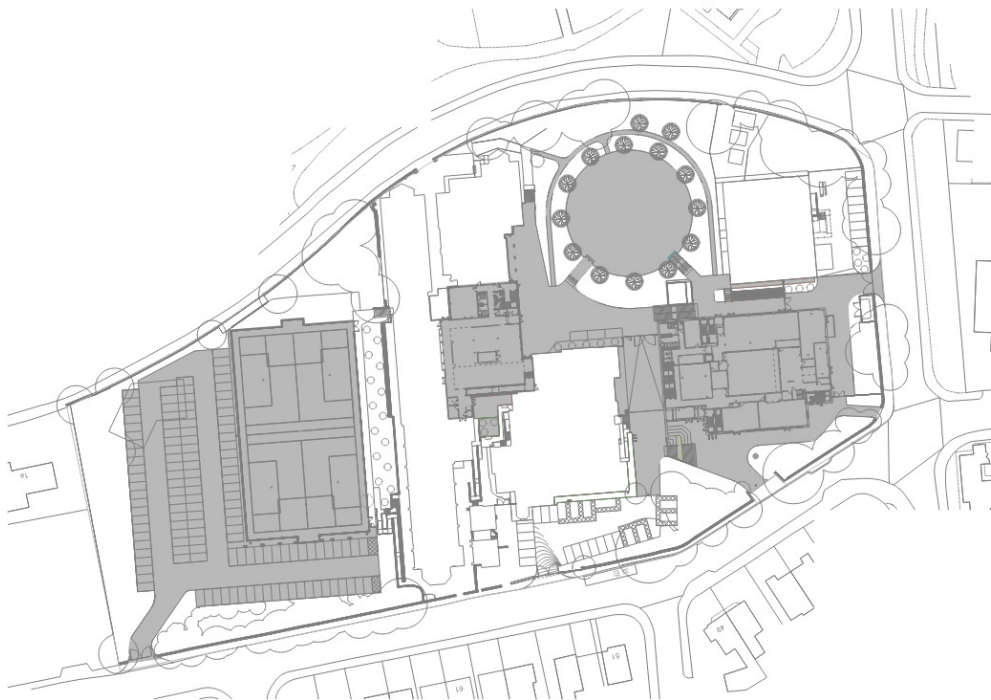


Figure 4: Area shown in grey indicates new hard standing/new buildings

In accordance with local and national policies, the development will ensure no flooding for up to and including the 30-year return period and no overland flooding affecting accommodation on site or any uncontrolled flows leaving the site for up to the 100-year return period with a further allowance for climate change (30%).

The proposed drainage layout can be seen in Appendix 6.

4.2.1 Surface Water Restrictions and SuDS Strategy

In accordance with the pre – application response from the LLFA the flow rate from the site shall be limited to 30% betterment of the current discharge rate. An existing drainage Microdrainage model (section 4.32) was made to determine the brownfield runoff rate. The model shows a discharge rate through the 4 connections of 180l/s. There is also a suspected overland flow route though the pedestrian entrance at the southeast of the college on to Greenhead Road. The peak overland flow from this area has been estimated at 32l/s using the modified rational method. The brownfield runoff rate is 212l/s. Therefore, the proposal is to restrict storm water flows to 149l/s for storms up to 1 in 100 year +30% climate change allowance.

4.2.2 Attenuation, SuDS and Water Treatment

The surface water elements and drainage design were conducted using a pragmatic approach. SuDS techniques selected for the site comprise of a green roof, permeable paving and geocellular storage.

4.2.2.1 Water Treatment

Using the simple index approach there are two separate area classifications

1. Non-residential Roofs
2. Non-residential carparking with infrequent change

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4

1. The vast majority of surface water treatment from the roof will be via a green roof (with a small area to discharge directly into the geocellular tanks where the plant and space requirement limit the extent of the green roof).
2. Surface Water treatment for all external hardstanding areas will be provided by permeable paving.

By using source control options, such as permeable paving and a green roof which provide both treatment and storage of the first 5mm of rainfall, the impact of the first flush is minimised. In accordance with Table 24.6 of the CIRIA SuDS C753 manual both green roof and permeable paving are deemed to satisfy the requirements of interception.

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters

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

4.2.2.2 Storage Requirements

To ensure the attenuation is available and protected for the risk of the occurrence of consecutive storms, the storage elements are designed to half empty within 24 hours and fully empty within 48 hours in the worst-case storm simulation. The total volume of storage provided by the geocellular tanks is 155m³.

4.2.2.3 Ownership

All drainage within the site boundary is privately owned and all new proposed drainage shall be privately drained.

4.3 Microdrainage model

Two models were produced to simulate both the existing network and the proposed network to review the impact the proposed development had on flood risk.

4.3.1 Design Criteria

Table 1: Design Criteria

Design Criteria	Value
M5-60 (mm)	19
r	0.349
Climate Change (%)	30
Time of Entry (mins)	4
PIMP (%)	100

4.3.2 Existing site

An initial model was made to assess the hydraulic capacity on the existing network and to calculate the brownfield runoff rate. The design criteria outlined in section 4.3.1 was applied to the network, although the network was not designed to modern climate change standards. The model shows 43.4m³ of flooding for the critical storm duration (15mins, 1 in 100 year +30% climate change) with a discharge rate from the site of 180l/s. This discharge rate doesn't take into account the overland flow route to the southeast (peak discharge at approximately 32l/s). Therefore, the total peak discharge rate including overland flow is 212l/s. The results of the model can be seen in Appendix 7.

4.3.3 Proposed development

The proposed network model used the design criteria outlined in section 4.3.1. The model shows there is no flooding in the proposed drainage network for return periods up to and including 1 in 100 years + 30%cc and furthermore, flooding was reduced in the existing combined system to 3m³. The discharge rate for the site was reduced to 145l/s. To reduce the risk of flooding at internal manhole 13 it has been proposed that the cover be upgrade to a triple locked and sealed. This discharge rate is lower than the 30% betterment of brownfield (149l/s) required in the pre-application response. The results of this model can be seen in Appendix 8.

4.4 Flood Exceedance Routing

A flood exceedance plan has been produced to show the overland flood route for blockage or failure of the system. This has been produced in Appendix 9.

4.5 Proposed SuDS Maintenance Schedule

The following operation and maintenance schedules should be followed for the SuDS items with reference to the CIRIA SuDS Manual (2016) for additional guidance on each element. The operation and maintenance of the proposed SuDS features shall be the responsibility of the building occupier.

Permeable paving needs to be regularly cleaned of silt and other sediments to preserve their infiltration capacity. As per the table below, once a year should be sufficient, but inspection reports should be regularly checked by the management company to confirm that this is appropriate. A brush and suction cleaner should be used for regular sweeping, any jointing material lost should be replaced.

Table 2: Operation and Maintenance recommendations for permeable paving

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto permeable surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial actions	Remediate any landscape which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 hours after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

The **Green Roof** will require regular maintenance and inspection. Most maintenance is generally required during the establishment stage (12 to 15 months). Where possible this should be delegated to specialist trained contractors.

Table 3: Operation and Maintenance recommendations for green roof

Maintenance Schedule	Required Action	Frequency
Regular inspections	Inspect all components including soil substrate, vegetation, drains, membranes and roof structure for proper operation, integrity of waterproofing and structural stability	Annually and after severe storms
	Inspect soil substrate for evidence of erosion channels and identify any sediment sources	Annually and after severe storms
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Annually and after severe storms
	Inspect underside of roof for evidence of leakage	Annually and after severe storms
Regular maintenance	Remove debris and litter to prevent clogging of inlet drains and interference with plant growth	Six months and annually or as required
	During establishment (i.e. year one), replace dead plants as required	Monthly (but usually responsibility of manufacturer)
	Post establishment, replace dead plants as required (where >5% of coverage)	Annually (in autumn)
	Remove nuisance and invasive vegetation, including weeds	Six months or as required
	Mow grasses, prune shrubs and manage other planting – clippings should be removed and not allowed to accumulate	Six months or as required
Remedial actions	If erosion channels are evident, these should be stabilised with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled	As required
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

Geocellular storage needs to be regularly inspected and the necessary maintenance carried out to ensure their long-term operation capacity. The primary maintenance requirements will be removing litter and debris (monthly). As per the table below, once a year for most other maintenance should be sufficient, but inspection reports should be regularly checked by the management company to confirm that this is appropriate.

Table 4: Operation and Maintenance recommendations for geocellular storage

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risk to performance)	Monthly
Remedial actions	Repair/rehabilitate inlets, outlets, overflows and vents	As required
Monitoring	Inspect/check pipes to ensure that they are in good condition and operating as designed	Annually
	Survey inside of pipes for sediment build-up and remove if necessary	Every 5 years or as required

4.6 Foul Water

There is no net change in foul water flows from site and it shall continue to flow unrestricted to YW network. This has been noted in the pre-planning application correspondence.

5.0 Conclusions and Recommendations

5.1 Surface Water

There is no net increase to hard standing area in the development. Surface water flows are to be restricted to 149l/s (30% betterment to existing) which shall reduce flood risk and potential capacity issues downstream.

In accordance with current legislation, SuDS have been proposed at source, as both treatment and storage.

Attenuation is provided for the excess flows which provides storage for all events up to and including the 1 in 100 year plus 30% climate change design storm event.

Attenuation is proposed in the form of attenuation crates and permeable paving to provide storage for all events up to and including the 1 in 100 year plus 30% climate change design storm event.

Maintenance schedules for all SuDS elements have been included in this report.

5.2 Foul Water

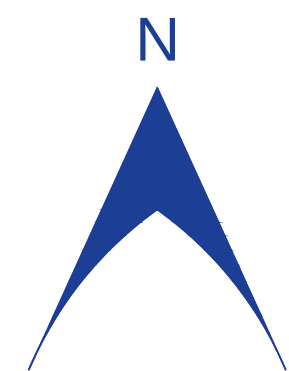
There is no net change in foul water flows from the site. Flows are to continue to discharge unrestricted into existing foul water drainage.

6.0 Appendices

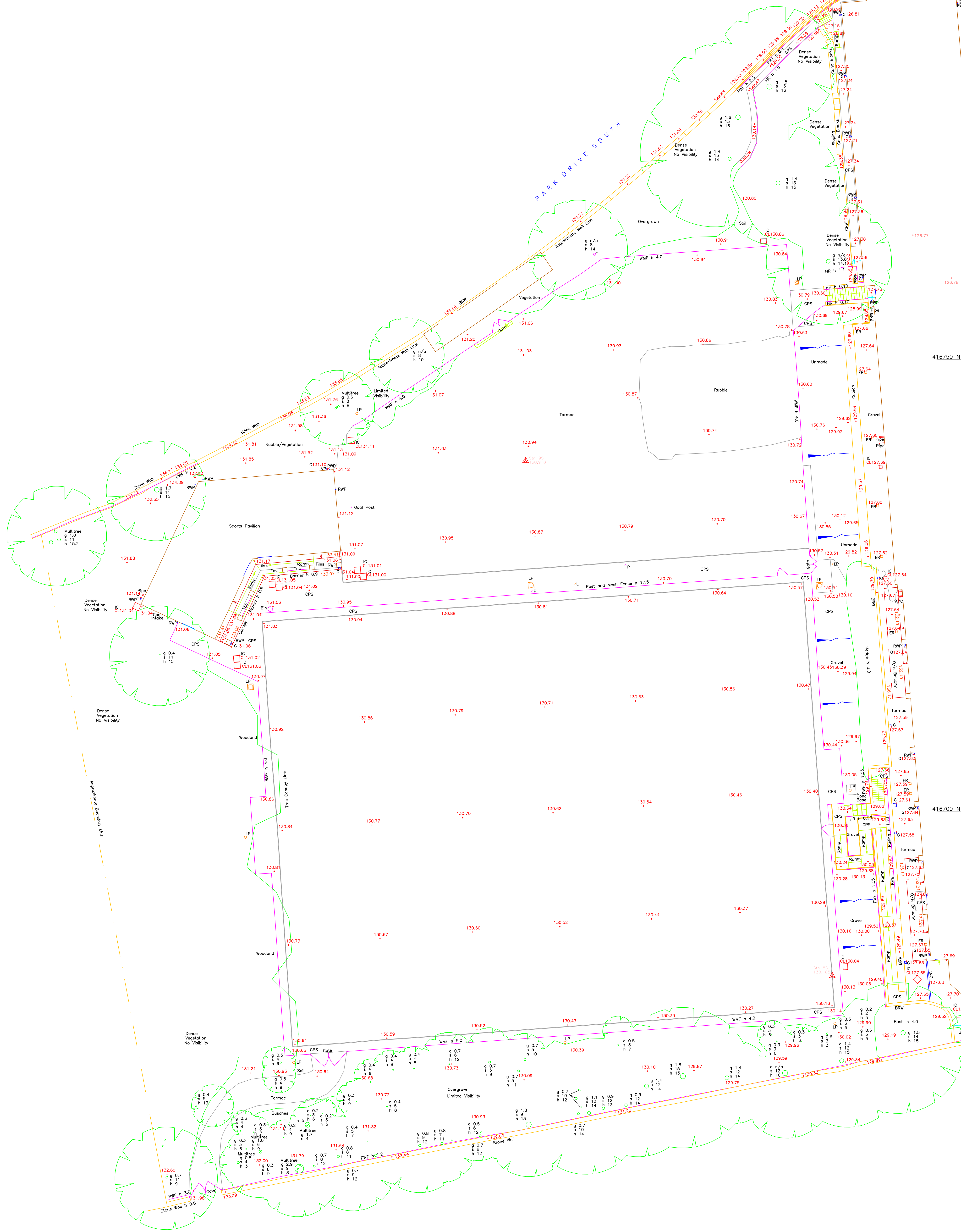
List of Appendices

1. Topographical Survey
2. Proposed Site Plan
3. Pre-Planning Enquiry Response
4. Yorkshire Water Sewer Plan
5. Existing Drainage
6. Proposed Drainage Layout
7. Existing Network Microdrainage Model
8. Proposed Network Microdrainage Model
9. Flood Exceedance Plan

6.1 Appendix 1 – Topographical Survey



SURVEY STATIONS			
Name	Easting	Northing	Height
2S	413793.217	416801.543	122.546
3S	413787.543	416739.838	124.335
4S	413822.335	416695.253	122.129
5S	413760.632	416670.387	125.700
8S	413705.530	416681.824	130.185
9S	413671.599	416738.814	130.918



The identification of service covers has been made by a surface inspection on critical identifications should be verified by the lifting of covers or a full utilities survey

Due to the inherent instability of paper materials, drawings plotted on paper may stretched and distorted - dimensions scaled from paper plots should therefore treated with caution

This drawing has been produced for the purpose of the original commissioning agent. Plowman Civils Limited will accept no responsibility for details that are subsequently found to be a consequence of undetected facts or that were observed from view at the time of survey or that been altered since the survey.

See www.plowmancivils.co.uk for full terms and conditions of contract.

This survey is commensurate with band F accuracy, as outlined in the RICS survey detail accuracy banding table

All levels are in metres and are above Ordnance Survey Newlyn Data derived by multiple network RTK GPS observations

The survey grid shown on this drawing is positioned on Ordnance Survey (OS) National Grid, obtained by multiple network RTK GPS observations

Unless otherwise stated, levels have been taken to finished floor surface

All quoted dimensions are in metres

Drawing units are metres

PROJECT TITLE

3D Topographical survey

DATE OF ORIGINAL SURVEY September 2001

DRAWING No. ISSUE

45774-013T-01-1 A

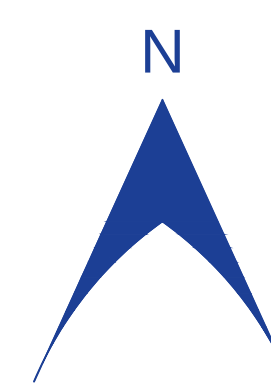
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All levels are in metres and are above Ordnance Survey Newlyn Data derived by multiple network RTK GPS observations

The survey grid shown on this drawing is positioned on Ordnance Survey (OS) National Grid, obtained by multiple network RTK GPS observations

Unless otherwise stated, levels have been taken to finished floor surface

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Drawing units are metres

3D Topographical survey
PRESENTATION SCALE 1:200 @ A0
DATE OF ORIGINAL SURVEY September 2013
PC PROJECT No. 45774-013 CHECKED M
DRAWING No. ISSUE
45774-013T-01-2 A

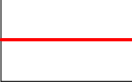
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6.2 Appendix 2 – Proposed Site Plan

Legend



Site Boundary

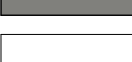
Hardworks



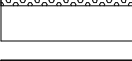
Proposed Tarmacadam - Impermeable



Proposed Tarmacadam - Permeable



Tactile Paving



Paving Type 1 - Permeable



Existing Surfacing



Steps



Electric charging point



Proposed Grass



Proposed all weather pitch (astroturf)



Proposed Ornamental Planting



Proposed Wildflower Planting



Proposed Woodland Planting



Proposed Climbing Planting

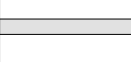


Proposed Tree

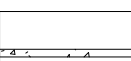


Existing Tree

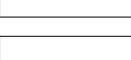
Walls and Fencing



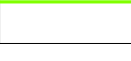
Existing walls to be retained



Proposed walls



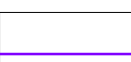
Existing fencing to be retained



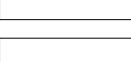
Proposed 3.0m high weldmesh fencing



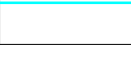
Proposed 2.4m high weldmesh fencing



Proposed 2.4m high timber fencing



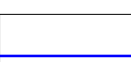
Proposed 1.8m high weldmesh fencing



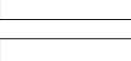
Proposed 1.8m high acoustic fencing



Timber close boarded fence with no gaps



Proposed 1.8m timber fence



Proposed handrail to steps



Proposed balustrading



Double and single gates

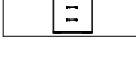
Site



Proposed defibrillator location



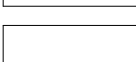
Proposed staff/pupil cycle shelter
5 no. cycle hoops (10 spaces)
2.4m x 5m



Proposed visitor cycle stands

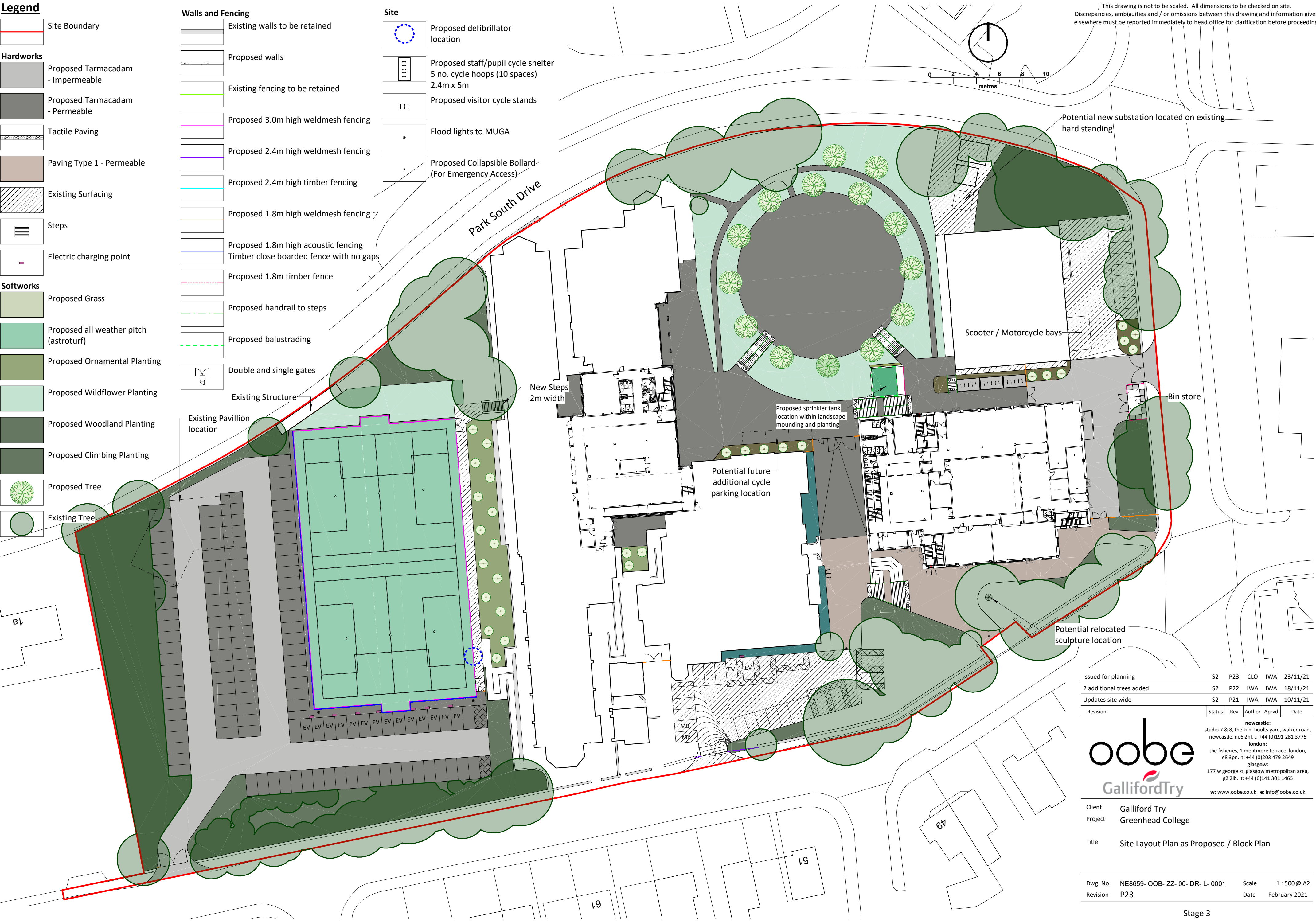


Flood lights to MUGA



Proposed Collapsible Bollard
(For Emergency Access)

/ This drawing is not to be scaled. All dimensions to be checked on site. Discrepancies, ambiguities and / or omissions between this drawing and information given elsewhere must be reported immediately to head office for clarification before proceeding.



Issued for planning	S2	P23	CLO	IWA	23/11/21
2 additional trees added	S2	P22	IWA	IWA	18/11/21
Updates site wide	S2	P21	IWA	IWA	10/11/21
Revision	Status	Rev	Author	Aprvd	Date

newcastle:
studio 7 & 8, the kiln, hoults yard, walker road,
newcastle, ne6 2hl. t: +44 (0)191 281 3775

london:
the fisheries, 1 mentmore terrace, london,
e8 3pn. t: +44 (0)203 479 2649

glasgow:
177 w george st, glasgow metropolitan area,
g2 2lb. t: +44 (0)141 301 1465

w: www.oobe.co.uk e: info@oobe.co.uk

Client	Galliford Try
Project	Greenhead College
Title	Site Layout Plan as Proposed / Block Plan

Dwg. No.	NE8659- OOB- ZZ- 00- DR- L- 0001	Scale	1 : 500 @ A2
Revision	P23	Date	February 2021

6.3 Appendix 3 – Pre-Planning Enquiry Response

**For telephone enquiries ring:
George Mullaney on 0345 120 8482**

29th April 2021

Your Ref:

Our Ref: X007875

**Greenhead College, Greenhead Road, Huddersfield, HD1 4ER – Pre-
Planning Sewerage Enquiry – Commercial – U229138**

Thank you for your recent enquiry and remittance. Our official VAT receipt has been sent to you under separate cover. Please find enclosed a complimentary extract from the Statutory Sewer Map which indicates the recorded position of the public sewers. Please note that as of October 2011 and the private to public sewer transfer, there are many uncharted Yorkshire Water assets currently not shown on our records.

The following comments reflect our view, with regard to the public sewer network only, based on a 'desk top' study of the site and are valid for a maximum period of twelve months:

Development of the site should take place with separate systems for foul and surface water drainage on site, with a combined sewer off site.



YorkshireWater

Foul Water

Foul water domestic waste can discharge to the 450mm diameter public combined sewer recorded in Greenhead Road but existing private foul drainage can be utilised.

Foul water from kitchens and/or food preparation areas of any restaurants and/or canteens etc. must pass through a fat and grease trap of adequate design before any discharge to the public sewer network.

Surface Water

The developer's attention is drawn to Requirement H3 of the Building Regulations 2000. This establishes a preferred hierarchy for surface water disposal. Consideration should firstly be given to discharge to soakaway, infiltration system and watercourse in that priority order.

Sustainable Drainage Systems (SuDS), for example the use of soakaways and/or permeable hardstanding etc, may be a suitable solution for surface water disposal appropriate in this situation. You are advised to seek comments on the suitability of SuDS in this instance from the appropriate authorities.

Looking at the information provided peak flows have been used to calculate existing flows. Yorkshire Water require the below guidance to be used when assessing the site. We also need to know the size and fall on the final outfalls from the surface water systems into the combined systems to see if any were acting as throttles.

If other methods of surface water disposal are not viable and subject to providing satisfactory evidence as to why they have been discounted, curtilage surface water discharges to the public sewer will be restricted to the level of run-off - i.e. same rate of discharge - to that from the existing use of the site less a 30% reduction in the existing discharge. Any discharge of surface water from the site should discharge to similar points of connection to that of the existing use of the site.



You will need to demonstrate positive drainage, based on a 1 in 1 year storm, to the public sewer to Yorkshire Water by means of investigation and calculation carried out at your expense.

To do this, Yorkshire Water requires to see existing and proposed drainage layouts with pipe sizes, gradients, gullies, downpipes and connection points, measured impermeable areas of the present and proposed use of the site, along with the calculations that show the existing and proposed discharge rate from the site to the public sewer.

Surface water run-off from communal parking (greater than 800 sq metres or more than 50 car parking spaces) and hardstanding must pass through an oil, petrol and grit interceptor/separator of adequate design before any discharge to the public sewer network. Roof water should not pass through the traditional 'stage' or full retention type of interceptor/separator. It is good drainage practice for any interceptor/separator to be located upstream of any on-site balancing, storage or other means of flow attenuation that may be required.

Other Observations

Any new connection to an existing public sewer will require the prior approval of Yorkshire Water. You may apply on line or obtain an application form from our website (www.yorkshirewater.com) or by telephoning 0345 120 84 82.

Under the provisions of section 111 of the Water Industry Act 1991 it is unlawful to pass into any public sewer (or into any drain or private sewer communicating with the public sewer network) any items likely to cause damage to the public sewer network interfere with the free flow of its contents or affect the treatment and disposal of its contents. Amongst other things this includes fat, oil, nappies, bandages, syringes, medicines, sanitary towels and incontinence pants. Contravention of the provisions of section 111 is a criminal offence.



YorkshireWater

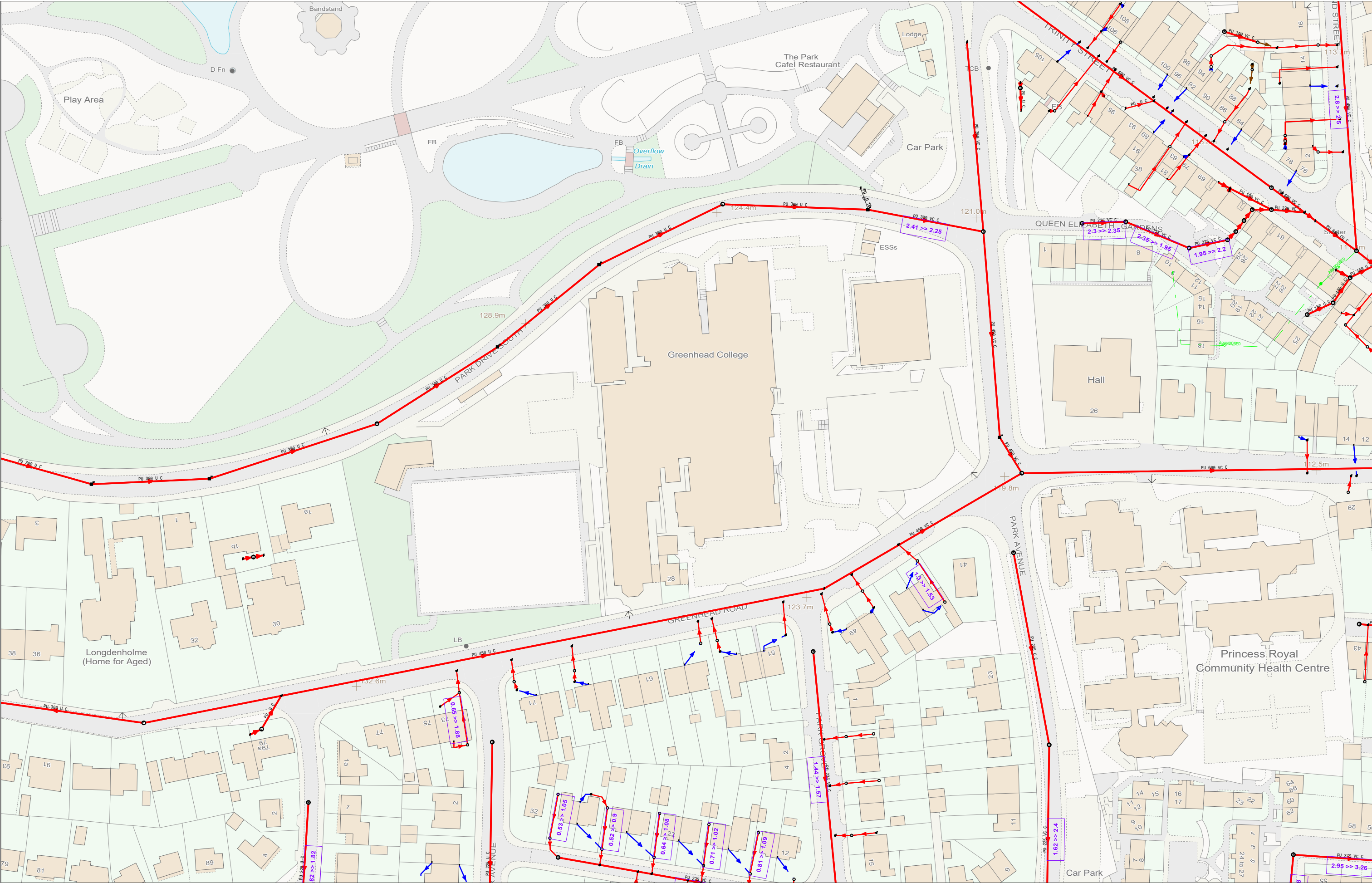
Yorkshire Water's Trade Effluent team must be consulted in respect of any proposed trade effluent discharge to the public sewer.

All the above comments are based upon the information and records available at the present time and is subject to formal planning approval agreement. The information contained in this letter together with that shown on any extract from the Statutory Sewer Map that may be enclosed is believed to be correct and is supplied in good faith. Please note that capacity in the public sewer network is not reserved for specific future development. It is used up on a 'first come, first served' basis. You should visit the site and establish the line and level of any public sewers affecting your proposals before the commencement of any design work.

Yours sincerely

George Mullaney
Development Services Technician

6.4 Appendix 4 – Yorkshire Water Plan



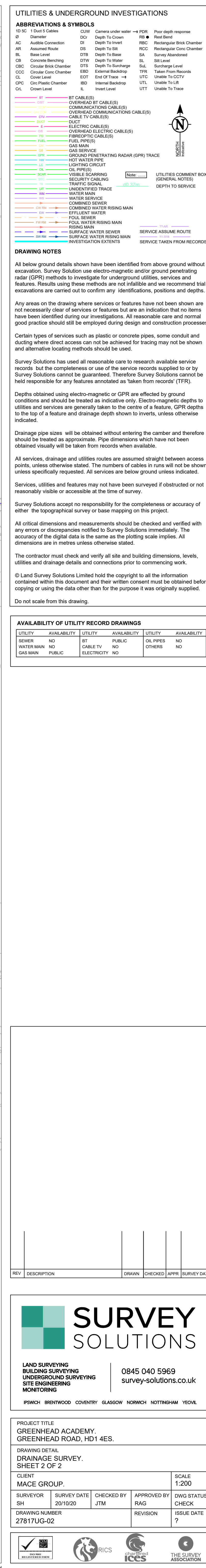
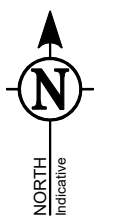
Date Requested : 15/01/2021, 14:33:32
Date Generated : 15/01/2021, 14:33:34

Scale : 1:1250
The position and depth of any YW apparatus shown on this map are approximate only.

UPN: Undefined
Originator: S P Midgley, Waste Water Technical, 75 4486

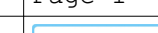
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Copyright for additional data shown on this map may rest with: British Geological Survey, Natural England, Environment Agency, Natural Environment Research Council, The MET Office, DEFRA, George Philip Ltd., Royal Mail, Cranfield University and Yorkshire Water.

6.5 Appendix 5 – Existing Drainage



6.6 Appendix 6 – Proposed Drainage Layout

6.7 Appendix 7 – Existing Network Microdrainage Model

Cundall, Johnston & Partners		Page 1
Horsley House Regent Centre, Gosforth Newcastle upon Tyne NE3 3LU	Existing Model Greenhead	
Date 10/11/2021 File EXISITNG NETWORK.MDX	Designed by MAK Checked by MLC	
Micro Drainage	Network 2020.1	

STORM SEWER DESIGN by the Modified Rational Method

Pipe Sizes STANDARD Manhole Sizes STANDARD

Designed with Level Soffits

« - Indicates pipe capacity < flow

Network Results Table

Cundall, Johnston & Partners

Horsley House
Regent Centre, Gosforth
Newcastle upon Tyne NE3 3LU

Date 10/11/2021
File EXISITNG NETWORK.MDX

Existing Model
Greenhead

Designed by MAK
Checked by MLC

Micro Drainage

Network 2020.1

Page 2



Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
5.000	31.797	0.619	51.4	0.021	4.00	0.0	0.600	o	150	Pipe/Conduit	
3.004	8.644	0.148	58.4	0.053	0.00	0.0	0.600	o	150	Pipe/Conduit	
6.000	43.415	0.970	44.8	0.088	4.00	0.0	0.600	o	150	Pipe/Conduit	
7.000	47.660	2.440	19.5	0.192	4.00	0.0	0.600	o	150	Pipe/Conduit	
6.001	23.555	0.942	25.0	0.049	0.00	0.0	0.600	o	150	Pipe/Conduit	
6.002	10.013	0.110	91.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
8.000	16.855	0.220	76.6	0.033	4.00	0.0	0.600	o	100	Pipe/Conduit	
8.001	9.816	0.130	75.5	0.019	0.00	0.0	0.600	o	100	Pipe/Conduit	
8.002	7.656	0.250	30.6	0.020	0.00	0.0	0.600	o	150	Pipe/Conduit	
8.003	22.929	1.250	18.3	0.064	0.00	0.0	0.600	o	150	Pipe/Conduit	
8.004	26.470	1.020	26.0	0.041	0.00	0.0	0.600	o	150	Pipe/Conduit	
8.005	21.941	0.410	53.5	0.036	0.00	0.0	0.600	o	150	Pipe/Conduit	
8.006	21.865	0.375	58.3	0.050	0.00	0.0	0.600	o	150	Pipe/Conduit	
8.007	21.545	0.368	58.5	0.011	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
5.000	50.00	4.38	126.170	0.021	0.0	0.0	0.0	1.41	24.9	2.8
3.004	50.00	5.45	125.480	0.226	0.0	0.0	0.0	1.32	23.3«	30.6
6.000	50.00	4.48	121.840	0.088	0.0	0.0	0.0	1.51	26.7	11.9
7.000	50.00	4.35	123.310	0.192	0.0	0.0	0.0	2.29	40.5	26.0
6.001	50.00	4.67	120.870	0.328	0.0	0.0	0.0	2.02	35.7«	44.5
6.002	50.00	4.83	120.160	0.328	0.0	0.0	0.0	1.05	18.6«	44.5
8.000	50.00	4.32	126.130	0.033	0.0	0.0	0.0	0.88	6.9	4.5
8.001	50.00	4.50	125.910	0.052	0.0	0.0	0.0	0.89	7.0«	7.0
8.002	50.00	4.57	125.780	0.072	0.0	0.0	0.0	1.83	32.3	9.8
8.003	50.00	4.74	125.530	0.136	0.0	0.0	0.0	2.36	41.8	18.4
8.004	50.00	4.96	124.280	0.177	0.0	0.0	0.0	1.98	35.1	24.0
8.005	50.00	5.22	123.260	0.213	0.0	0.0	0.0	1.38	24.4«	28.9
8.006	50.00	5.50	122.850	0.263	0.0	0.0	0.0	1.32	23.3«	35.6
8.007	50.00	5.77	122.475	0.274	0.0	0.0	0.0	1.32	23.3«	37.0

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Horsley House Regent Centre, Gosforth Newcastle upon Tyne NE3 3LU	Existing Model Greenhead	
Date 10/11/2021 File EXISITNG NETWORK.MDX	Designed by MAK Checked by MLC	
Micro Drainage		Network 2020.1

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
2.000	User	-	100	0.009	0.009	0.009
2.001	User	-	100	0.018	0.018	0.018
2.002	User	-	100	0.041	0.041	0.041
3.000	User	-	100	0.023	0.023	0.023
4.000	User	-	100	0.053	0.053	0.053
3.001	User	-	100	0.030	0.030	0.030
3.002	User	-	100	0.047	0.047	0.047
3.003	-	-	100	0.000	0.000	0.000
5.000	User	-	100	0.021	0.021	0.021
3.004	User	-	100	0.053	0.053	0.053
6.000	User	-	100	0.088	0.088	0.088
7.000	User	-	100	0.099	0.099	0.099
	User	-	100	0.054	0.054	0.153
	User	-	100	0.039	0.039	0.192
6.001	User	-	100	0.049	0.049	0.049
6.002	-	-	100	0.000	0.000	0.000
8.000	User	-	100	0.011	0.011	0.011
	User	-	100	0.022	0.022	0.033
8.001	User	-	100	0.019	0.019	0.019
8.002	User	-	100	0.020	0.020	0.020
8.003	User	-	100	0.024	0.024	0.024
	User	-	100	0.040	0.040	0.064
8.004	User	-	100	0.041	0.041	0.041
8.005	User	-	100	0.036	0.036	0.036
8.006	User	-	100	0.050	0.050	0.050
8.007	User	-	100	0.011	0.011	0.011
				Total	Total	Total
				0.896	0.896	0.896

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
---------------------	--------------	--------------	--------------	------------------	----------	--------

2.002		131.500	129.513	129.513	300	0
-------	--	---------	---------	---------	-----	---

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
---------------------	--------------	--------------	--------------	------------------	----------	--------

3.004		127.300	125.332	125.330	450	0
-------	--	---------	---------	---------	-----	---

Cundall, Johnston & Partners			Page 4			
Horsley House Regent Centre, Gosforth Newcastle upon Tyne NE3 3LU		Existing Model Greenhead				
Date 10/11/2021 File EXISITNG NETWORK.MDX		Designed by MAK Checked by MLC				
Micro Drainage		Network 2020.1				
<u>Free Flowing Outfall Details for Storm</u>						
Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
6.002		122.400	120.050	120.050	450	0
<u>Free Flowing Outfall Details for Storm</u>						
Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
8.007		124.500	122.107	122.107	300	0
<u>Simulation Criteria for Storm</u>						
Volumetric Runoff Coeff 0.750 Additional Flow - % of Total Flow 0.000						
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) 60						
Foul Sewage per hectare (l/s) 0.000 Output Interval (mins) 1						
Number of Input Hydrographs 0 Number of Storage Structures 0						
Number of Online Controls 0 Number of Time/Area Diagrams 0						
Number of Offline Controls 0 Number of Real Time Controls 0						
<u>Synthetic Rainfall Details</u>						
Rainfall Model		FSR		Profile Type		Summer
Return Period (years)		100		Cv (Summer)		0.750
Region		England and Wales		Cv (Winter)		0.840
M5-60 (mm)		19.000		Storm Duration (mins)		30
Ratio R		0.349				
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Regent Centre, Gosforth
Newcastle upon Tyne NE3 3LU

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Micro Drainage

Existing Model
Greenhead

Designed by MAK
Checked by MLC

Network 2020.1

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1 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 0.000

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 Storage Structures 0

Number of Online Controls 0

Number of Time/Area Diagrams 0

Number of Offline Controls 0

Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR

Ratio R 0.350

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

DVD Status ON

Analysis Timestep Fine

Inertia Status ON

DTS Status ON

Profile(s) Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880

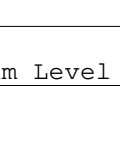
Return Period(s) (years) 1, 30, 100

Climate Change (%) 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.
2.000	EX MH 44	15 Summer	1	+0%	30/15 Summer			
2.001	EXMH 42	15 Winter	1	+0%	30/15 Summer			
2.002	EX MH 40	15 Winter	1	+0%	30/15 Summer			
3.000	EX MH 18	15 Summer	1	+0%	30/15 Summer	100/15 Summer		
4.000	EX MH 15	15 Winter	1	+0%	30/15 Summer	100/15 Summer		
3.001	EX MH19	15 Winter	1	+0%	30/15 Summer	100/15 Summer		
3.002	EX MH20	15 Winter	1	+0%	30/15 Summer			
3.003	EX MH22	15 Winter	1	+0%	30/15 Summer			
5.000	EX MH 25	15 Winter	1	+0%	100/15 Summer			
3.004	EX MH 24	15 Winter	1	+0%	1/15 Summer			
6.000	EX MH 29	15 Winter	1	+0%	30/15 Summer	100/15 Winter		
7.000	EX MH 04	15 Winter	1	+0%	30/15 Summer	30/15 Summer		
6.001	EX MH 01	15 Winter	1	+0%	1/15 Summer			
6.002	EX MH 02	15 Winter	1	+0%	1/15 Summer			
8.000	EX MH 13	15 Winter	1	+0%	30/15 Summer	100/15 Summer		
8.001	EX MH 14	15 Winter	1	+0%	30/15 Summer	100/15 Summer		
8.002	EX MH 16	15 Winter	1	+0%	30/15 Summer	100/15 Summer		
8.003	EX MH 46	15 Winter	1	+0%	30/15 Summer	100/15 Summer		
8.004	EX MH 11	15 Winter	1	+0%	30/15 Summer	100/15 Winter		
8.005	EX MH 07	15 Winter	1	+0%	1/15 Summer	100/15 Summer		

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Horsley House Regent Centre, Gosforth Newcastle upon Tyne NE3 3LU		Existing Model Greenhead						
Date 10/11/2021 File EXISITNG NETWORK.MDX		Designed by MAK Checked by MLC						
Micro Drainage		Network 2020.1						
1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm								
PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
2.000	EX MH 44	130.099	-0.071	0.000	0.19		1.3	OK
2.001	EXMH 42	129.978	-0.052	0.000	0.47		3.1	OK
2.002	EX MH 40	129.862	-0.078	0.000	0.46		7.4	OK
3.000	EX MH 18	127.024	-0.116	0.000	0.12		3.1	OK
4.000	EX MH	127.058	-0.082	0.000	0.41		7.0	OK
3.001	EX MH19	126.760	-0.060	0.000	0.66		13.1	OK
3.002	EX MH20	126.173	-0.057	0.000	0.70		18.0	OK
3.003	EX MH22	125.984	-0.066	0.000	0.60		17.9	OK
5.000	EX MH 25	126.204	-0.116	0.000	0.12		2.8	OK
3.004	EX MH 24	125.709	0.079	0.000	1.25		25.5	SURCHARGED
6.000	EX MH 29	121.911	-0.079	0.000	0.45		11.8	OK
7.000	EX MH 04	123.399	-0.061	0.000	0.66		25.8	OK
6.001	EX MH 01	121.713	0.693	0.000	1.04		35.4	SURCHARGED
6.002	EX MH 02	120.690	0.380	0.000	2.11		35.0	SURCHARGED
8.000	EX MH 13	126.191	-0.039	0.000	0.68		4.5	OK
8.001	EX MH 14	125.991	-0.019	0.000	0.99		6.4	OK
8.002	EX MH 16	125.837	-0.093	0.000	0.31		8.6	OK
8.003	EX MH 46	125.595	-0.085	0.000	0.39		15.4	OK
8.004	EX MH 11	124.364	-0.066	0.000	0.59		19.7	OK
8.005	EX MH 07	123.509	0.099	0.000	0.93		21.5	SURCHARGED
	PN	US/MH Name	Level Exceeded					
	2.000	EX MH 44						
	2.001	EXMH 42						
	2.002	EX MH 40						
	3.000	EX MH 18	4					
	4.000	EX MH	6					
	3.001	EX MH19	4					
	3.002	EX MH20						
	3.003	EX MH22						
	5.000	EX MH 25						
	3.004	EX MH 24						
	6.000	EX MH 29	1					
	7.000	EX MH 04	10					
	6.001	EX MH 01						
	6.002	EX MH 02						
	8.000	EX MH 13	6					
	8.001	EX MH 14	6					
	8.002	EX MH 16	5					
	8.003	EX MH 46	4					
	8.004	EX MH 11	1					
	8.005	EX MH 07	6					
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Micro Drainage Network 2020.1		

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 0.000
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 Storage Structures 0
Number of Online Controls	0	Number of Time/Area Diagrams 0
Number of Offline Controls	0	Number of Real Time Controls 0
Synthetic Rainfall Details		
Rainfall Model	FSR	Ratio R 0.350
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	DVD Status ON
Analysis Timestep	Fine	Inertia Status ON
DTS Status	ON	
Profile(s)	Summer and Winter	
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880	
Return Period(s) (years)	1, 30, 100	
Climate Change (%)	0, 0, 30	

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.
2.000	EX MH 44	15 Winter	30	+0%	30/15 Summer			
2.001	EXMH 42	15 Winter	30	+0%	30/15 Summer			
2.002	EX MH 40	15 Winter	30	+0%	30/15 Summer			
3.000	EX MH 18	15 Winter	30	+0%	30/15 Summer	100/15 Summer		
4.000	EX MH	15 Winter	30	+0%	30/15 Summer	100/15 Summer		
3.001	EX MH19	15 Winter	30	+0%	30/15 Summer	100/15 Summer		
3.002	EX MH20	15 Winter	30	+0%	30/15 Summer			
3.003	EX MH22	15 Winter	30	+0%	30/15 Summer			
5.000	EX MH 25	15 Winter	30	+0%	100/15 Summer			
3.004	EX MH 24	15 Winter	30	+0%	1/15 Summer			
6.000	EX MH 29	15 Winter	30	+0%	30/15 Summer	100/15 Winter		
7.000	EX MH 04	15 Winter	30	+0%	30/15 Summer	30/15 Summer		
6.001	EX MH 01	15 Winter	30	+0%	1/15 Summer			
6.002	EX MH 02	15 Winter	30	+0%	1/15 Summer			
8.000	EX MH 13	15 Winter	30	+0%	30/15 Summer	100/15 Summer		
8.001	EX MH 14	15 Winter	30	+0%	30/15 Summer	100/15 Summer		
8.002	EX MH 16	15 Winter	30	+0%	30/15 Summer	100/15 Summer		
8.003	EX MH 46	15 Winter	30	+0%	30/15 Summer	100/15 Summer		
8.004	EX MH 11	15 Winter	30	+0%	30/15 Summer	100/15 Winter		
8.005	EX MH 07	15 Winter	30	+0%	1/15 Summer	100/15 Summer		

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
2.000	EX MH 44	130.206	0.036	0.000	0.43			2.9	SURCHARGED
2.001	EXMH 42	130.187	0.157	0.000	1.13			7.5	SURCHARGED
2.002	EX MH 40	130.040	0.100	0.000	1.16			18.6	SURCHARGED
3.000	EX MH 18	127.342	0.202	0.000	0.28			7.3	SURCHARGED
4.000	EX MH	127.429	0.289	0.000	0.78			13.3	FLOOD RISK
3.001	EX MH19	127.327	0.507	0.000	0.98			19.6	SURCHARGED
3.002	EX MH20	126.792	0.562	0.000	1.10			28.0	SURCHARGED
3.003	EX MH22	126.569	0.519	0.000	1.00			29.6	SURCHARGED
5.000	EX MH 25	126.246	-0.074	0.000	0.29			6.9	OK
3.004	EX MH 24	126.214	0.584	0.000	2.21			45.2	SURCHARGED
6.000	EX MH 29	123.975	1.985	0.000	0.63			16.2	SURCHARGED
7.000	EX MH 04	124.752	1.292	1.876	0.82			32.2	FLOOD
6.001	EX MH 01	123.586	2.566	0.000	1.56			52.8	SURCHARGED
6.002	EX MH 02	121.295	0.985	0.000	3.16			52.4	SURCHARGED
8.000	EX MH 13	126.626	0.396	0.000	1.00			6.7	FLOOD RISK
8.001	EX MH 14	126.467	0.457	0.000	1.56			10.1	FLOOD RISK
8.002	EX MH 16	126.258	0.328	0.000	0.56			15.5	SURCHARGED
8.003	EX MH 46	126.219	0.539	0.000	0.74			29.3	SURCHARGED
8.004	EX MH 11	125.824	1.394	0.000	0.89			29.7	SURCHARGED
8.005	EX MH 07	125.016	1.606	0.000	1.59			36.7	FLOOD RISK

PN	US/MH Name	Level Exceeded
2.000	EX MH 44	
2.001	EXMH 42	
2.002	EX MH 40	
3.000	EX MH 18	4
4.000	EX MH	6
3.001	EX MH19	4
3.002	EX MH20	
3.003	EX MH22	
5.000	EX MH 25	
3.004	EX MH 24	
6.000	EX MH 29	1
7.000	EX MH 04	10
6.001	EX MH 01	
6.002	EX MH 02	
8.000	EX MH 13	6
8.001	EX MH 14	6
8.002	EX MH 16	5
8.003	EX MH 46	4
8.004	EX MH 11	1
8.005	EX MH 07	6

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Greenhead

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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 0.000

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 Storage Structures 0

Number of Online Controls 0

Number of Time/Area Diagrams 0

Number of Offline Controls 0

Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR

Ratio R 0.350

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

DVD Status ON

Analysis Timestep Fine

Inertia Status ON

DTS Status ON

Profile(s) Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880

Return Period(s) (years) 1, 30, 100

Climate Change (%) 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.
2.000	EX MH 44	15 Winter	100	+30%	30/15 Summer			
2.001	EXMH 42	15 Winter	100	+30%	30/15 Summer			
2.002	EX MH 40	15 Winter	100	+30%	30/15 Summer			
3.000	EX MH 18	15 Winter	100	+30%	30/15 Summer	100/15 Summer		
4.000	EX MH 15	15 Winter	100	+30%	30/15 Summer	100/15 Summer		
3.001	EX MH19	15 Winter	100	+30%	30/15 Summer	100/15 Summer		
3.002	EX MH20	15 Winter	100	+30%	30/15 Summer			
3.003	EX MH22	15 Winter	100	+30%	30/15 Summer			
5.000	EX MH 25	15 Winter	100	+30%	100/15 Summer			
3.004	EX MH 24	15 Winter	100	+30%	1/15 Summer			
6.000	EX MH 29	15 Winter	100	+30%	30/15 Summer	100/15 Winter		
7.000	EX MH 04	30 Winter	100	+30%	30/15 Summer	30/15 Summer		
6.001	EX MH 01	15 Winter	100	+30%	1/15 Summer			
6.002	EX MH 02	15 Winter	100	+30%	1/15 Summer			
8.000	EX MH 13	30 Winter	100	+30%	30/15 Summer	100/15 Summer		
8.001	EX MH 14	30 Winter	100	+30%	30/15 Summer	100/15 Summer		
8.002	EX MH 16	15 Winter	100	+30%	30/15 Summer	100/15 Summer		
8.003	EX MH 46	15 Winter	100	+30%	30/15 Summer	100/15 Summer		
8.004	EX MH 11	15 Winter	100	+30%	30/15 Summer	100/15 Winter		
8.005	EX MH 07	15 Winter	100	+30%	1/15 Summer	100/15 Summer		

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Micro Drainage

Existing Model
Greenhead

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
2.000	EX MH 44	130.723	0.553	0.000	0.68		4.6	SURCHARGED
2.001	EXMH 42	130.694	0.664	0.000	1.61		10.7	SURCHARGED
2.002	EX MH 40	130.441	0.501	0.000	1.65		26.6	SURCHARGED
3.000	EX MH 18	127.690	0.550	0.314	0.39		10.2	FLOOD
4.000	EX MH	127.608	0.468	7.595	1.28		21.7	FLOOD
3.001	EX MH19	127.642	0.822	1.712	1.18		23.6	FLOOD
3.002	EX MH20	127.533	1.303	0.000	1.29		33.1	FLOOD RISK
3.003	EX MH22	127.262	1.212	0.000	1.06		31.5	SURCHARGED
5.000	EX MH 25	126.877	0.557	0.000	0.38		9.0	SURCHARGED
3.004	EX MH 24	126.812	1.182	0.000	2.97		60.5	SURCHARGED
6.000	EX MH 29	125.940	3.950	0.279	1.21		31.2	FLOOD
7.000	EX MH 04	124.773	1.313	22.967	1.00		39.4	FLOOD
6.001	EX MH 01	124.645	3.625	0.000	1.78		60.4	FLOOD RISK
6.002	EX MH 02	121.634	1.324	0.000	3.61		59.8	SURCHARGED
8.000	EX MH 13	126.763	0.533	3.123	1.55		10.2	FLOOD
8.001	EX MH 14	126.705	0.695	4.621	2.51		16.2	FLOOD
8.002	EX MH 16	126.723	0.793	2.883	0.69		19.3	FLOOD
8.003	EX MH 46	126.761	1.081	0.998	0.78		30.7	FLOOD
8.004	EX MH 11	126.540	2.110	0.028	1.12		37.6	FLOOD
8.005	EX MH 07	125.233	1.823	2.641	1.76		40.4	FLOOD

PN	US/MH Name	Level Exceeded
2.000	EX MH 44	
2.001	EXMH 42	
2.002	EX MH 40	
3.000	EX MH 18	4
4.000	EX MH	6
3.001	EX MH19	4
3.002	EX MH20	
3.003	EX MH22	
5.000	EX MH 25	
3.004	EX MH 24	
6.000	EX MH 29	1
7.000	EX MH 04	10
6.001	EX MH 01	
6.002	EX MH 02	
8.000	EX MH 13	6
8.001	EX MH 14	6
8.002	EX MH 16	5
8.003	EX MH 46	4
8.004	EX MH 11	1
8.005	EX MH 07	6

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6.8 Appendix 8 – Proposed Network Microdrainage Model

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File GREENHEAD MODEL_D.MDX

Greenhead Proposed

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Micro Drainage

Network 2020.1

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section	Type	Auto Design
5.000	32.373	0.320	101.2	0.055	4.00	0.0	0.600	o	150	Pipe/Conduit		
4.001	44.117	0.590	74.8	0.030	0.00	0.0	0.600	o	150	Pipe/Conduit		
4.002	6.123	0.180	34.0	0.047	0.00	0.0	0.600	o	150	Pipe/Conduit		
4.003	12.575	0.420	29.9	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit		
6.000	31.797	0.619	51.4	0.021	4.00	0.0	0.600	o	150	Pipe/Conduit		
4.004	8.644	0.148	58.4	0.053	0.00	0.0	0.600	o	150	Pipe/Conduit		
7.000	41.267	0.485	85.1	0.086	4.00	0.0	0.600	o	150	Pipe/Conduit		
7.001	16.614	0.300	55.4	0.049	0.00	0.0	0.600	o	150	Pipe/Conduit		
8.000	31.229	2.440	12.8	0.058	4.00	0.0	0.600	o	150	Pipe/Conduit		
7.002	24.711	0.455	54.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit		
9.000	34.525	0.115	300.2	0.017	4.00	0.0	0.600	o	100	Pipe/Conduit		
9.001	29.861	0.095	314.3	0.012	0.00	0.0	0.600	o	100	Pipe/Conduit		
9.002	12.903	0.045	286.7	0.016	0.00	0.0	0.600	o	100	Pipe/Conduit		
9.003	22.461	0.075	299.5	0.007	0.00	0.0	0.600	o	100	Pipe/Conduit		

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
5.000	50.00	4.54	126.990	0.055	0.0	0.0	0.0	1.00	17.7	7.5
4.001	50.00	5.17	126.670	0.108	0.0	0.0	0.0	1.16	20.6	14.6
4.002	50.00	5.23	126.080	0.155	0.0	0.0	0.0	1.73	30.6	20.9
4.003	50.00	5.34	125.900	0.155	0.0	0.0	0.0	1.85	32.6	20.9
6.000	50.00	4.38	126.170	0.021	0.0	0.0	0.0	1.41	24.9	2.8
4.004	50.00	5.45	125.480	0.228	0.0	0.0	0.0	1.32	23.3«	30.9
7.000	50.00	4.63	121.840	0.086	0.0	0.0	0.0	1.09	19.3	11.7
7.001	50.00	4.84	120.950	0.135	0.0	0.0	0.0	1.35	23.9	18.3
8.000	50.00	4.18	123.310	0.058	0.0	0.0	0.0	2.83	50.0	7.8
7.002	50.00	5.14	120.650	0.193	0.0	0.0	0.0	1.37	24.2«	26.1
9.000	50.00	5.31	120.550	0.017	0.0	0.0	0.0	0.44	3.4	2.4
9.001	50.00	6.47	120.435	0.029	0.0	0.0	0.0	0.43	3.4«	4.0
9.002	50.00	6.95	120.340	0.046	0.0	0.0	0.0	0.45	3.5«	6.2
9.003	50.00	7.80	120.295	0.053	0.0	0.0	0.0	0.44	3.5«	7.2

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Micro Drainage

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section	Type	Auto Design
10.000	9.483	0.030	316.1	0.015	4.00	0.0	0.600	o	100	Pipe/Conduit		
9.004	7.139	0.035	204.0	0.024	0.00	0.0	0.600	o	100	Pipe/Conduit		
7.003	17.803	0.178	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit		
11.000	12.260	0.055	222.9	0.080	4.00	0.0	0.600	o	300	Pipe/Conduit		
11.001	25.487	0.100	254.9	0.071	0.00	0.0	0.600	o	375	Pipe/Conduit		
12.000	27.605	1.100	25.1	0.037	4.00	0.0	0.600	o	100	Pipe/Conduit		
12.001	24.836	0.920	27.0	0.078	0.00	0.0	0.600	o	75	Pipe/Conduit		
13.000	49.787	0.100	497.9	0.042	4.00	0.0	0.600	o	75	Pipe/Conduit		
12.002	14.561	0.730	19.9	0.034	0.00	0.0	0.600	o	75	Pipe/Conduit		
11.002	11.057	0.050	221.1	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit		
11.003	16.846	0.050	336.9	0.100	0.00	0.0	0.600	o	375	Pipe/Conduit		
11.004	9.653	0.050	193.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit		
14.000	16.855	0.220	76.6	0.033	4.00	0.0	0.600	o	100	Pipe/Conduit		
14.001	9.816	0.130	75.5	0.019	0.00	0.0	0.600	o	100	Pipe/Conduit		

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	
10.000	50.00	4.37	120.250	0.015	0.0	0.0	0.0	0.43	3.4	2.0	
9.004	50.00	8.03	120.220	0.092	0.0	0.0	0.0	0.53	4.2«	12.5	
7.003	50.00	8.32	120.195	0.285	0.0	0.0	0.0	1.00	17.8«	38.6	
11.000	50.00	4.19	123.155	0.080	0.0	0.0	0.0	1.05	74.1	10.8	
11.001	50.00	4.57	123.100	0.151	0.0	0.0	0.0	1.13	124.8	20.4	
12.000	50.00	4.30	125.750	0.037	0.0	0.0	0.0	1.55	12.2	5.0	
12.001	50.00	4.63	124.650	0.115	0.0	0.0	0.0	1.23	5.4«	15.6	
13.000	50.00	6.99	123.850	0.042	0.0	0.0	0.0	0.28	1.2«	5.7	
12.002	50.00	7.15	123.730	0.191	0.0	0.0	0.0	1.43	6.3«	25.9	
11.002	50.00	7.31	123.000	0.342	0.0	0.0	0.0	1.21	134.1	46.3	
11.003	50.00	7.59	122.340	0.442	0.0	0.0	0.0	0.98	108.4	59.9	
11.004	50.00	7.82	122.255	0.442	0.0	0.0	0.0	0.72	12.7«	59.9	
14.000	50.00	4.32	126.130	0.033	0.0	0.0	0.0	0.88	6.9	4.5	
14.001	50.00	4.50	125.910	0.052	0.0	0.0	0.0	0.89	7.0«	7.0	

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Micro Drainage	Network 2020.1	

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
14.002	7.656	0.250	30.6	0.020	0.00	0.0	0.600	o	150	Pipe/Conduit	
14.003	22.929	1.250	18.3	0.024	0.00	0.0	0.600	o	150	Pipe/Conduit	
14.004	26.470	1.020	26.0	0.025	0.00	0.0	0.600	o	150	Pipe/Conduit	
14.005	21.941	0.410	53.5	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
11.005	23.002	0.153	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
14.002	50.00	4.57	125.780	0.072	0.0	0.0	0.0	1.83	32.3	9.8
14.003	50.00	4.74	125.530	0.096	0.0	0.0	0.0	2.36	41.8	13.0
14.004	50.00	4.96	124.280	0.121	0.0	0.0	0.0	1.98	35.1	16.4
14.005	50.00	5.22	123.260	0.121	0.0	0.0	0.0	1.38	24.4	16.4
11.005	50.00	8.28	122.250	0.563	0.0	0.0	0.0	0.82	14.5«	76.2

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Micro Drainage		Network 2020.1

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.071	0.071	0.071
2.000	User	-	100	0.050	0.050	0.050
3.000	User	-	100	0.212	0.212	0.212
1.001	User	-	100	0.071	0.071	0.071
1.002	-	-	100	0.000	0.000	0.000
4.000	User	-	100	0.023	0.023	0.023
5.000	User	-	100	0.055	0.055	0.055
4.001	User	-	100	0.030	0.030	0.030
4.002	User	-	100	0.047	0.047	0.047
4.003	-	-	100	0.000	0.000	0.000
6.000	User	-	100	0.021	0.021	0.021
4.004	User	-	100	0.053	0.053	0.053
7.000	User	-	100	0.086	0.086	0.086
7.001	User	-	100	0.049	0.049	0.049
8.000	User	-	100	0.058	0.058	0.058
7.002	-	-	100	0.000	0.000	0.000
9.000	User	-	100	0.017	0.017	0.017
9.001	User	-	100	0.012	0.012	0.012
9.002	User	-	100	0.016	0.016	0.016
9.003	User	-	100	0.007	0.007	0.007
10.000	User	-	100	0.015	0.015	0.015
9.004	User	-	100	0.024	0.024	0.024
7.003	-	-	100	0.000	0.000	0.000
11.000	User	-	100	0.080	0.080	0.080
11.001	User	-	100	0.071	0.071	0.071
12.000	User	-	100	0.037	0.037	0.037
12.001	User	-	100	0.078	0.078	0.078
13.000	User	-	100	0.042	0.042	0.042
12.002	User	-	100	0.034	0.034	0.034
11.002	-	-	100	0.000	0.000	0.000
11.003	-	-	100	0.100	0.100	0.100
11.004	-	-	100	0.000	0.000	0.000
14.000	User	-	100	0.011	0.011	0.011
	User	-	100	0.022	0.022	0.033
14.001	User	-	100	0.019	0.019	0.019
14.002	User	-	100	0.020	0.020	0.020
14.003	User	-	100	0.024	0.024	0.024
14.004	User	-	100	0.025	0.025	0.025
14.005	-	-	100	0.000	0.000	0.000
11.005	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				1.479	1.479	1.479

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)
1.002		131.500	129.513	129.513	300	0

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: EX MH 40, DS/PN: 1.002, Volume (m³): 1.4

Unit Reference	MD-SHE-0076-2100-0500-2100
Design Head (m)	0.500
Design Flow (l/s)	2.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	76
Invert Level (m)	129.790
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	2.1
Flush-Flo™	0.149	2.1
Kick-Flo®	0.345	1.8
Mean Flow over Head Range	-	1.8

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	2.0	1.200	3.1	3.000	4.8	7.000	7.2
0.200	2.1	1.400	3.4	3.500	5.2	7.500	7.4
0.300	2.0	1.600	3.6	4.000	5.5	8.000	7.7
0.400	1.9	1.800	3.8	4.500	5.8	8.500	7.9
0.500	2.1	2.000	4.0	5.000	6.1	9.000	8.2
0.600	2.3	2.200	4.1	5.500	6.4	9.500	8.4
0.800	2.6	2.400	4.3	6.000	6.7		
1.000	2.9	2.600	4.5	6.500	6.9		

Hydro-Brake® Optimum Manhole: SW 14, DS/PN: 9.004, Volume (m³): 1.9

Unit Reference	MD-SHE-0075-2200-0700-2200
Design Head (m)	0.700
Design Flow (l/s)	2.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	120.220
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

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<table><thead><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr></thead><tbody><tr><td>0.100</td><td>4.5</td><td>0.300</td><td>6.9</td><td>0.500</td><td>6.2</td><td>0.800</td><td>6.3</td></tr><tr><td>0.200</td><td>6.9</td><td>0.400</td><td>6.6</td><td>0.600</td><td>5.5</td><td>1.000</td><td>7.0</td></tr></tbody></table>						Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	4.5	0.300	6.9	0.500	6.2	0.800	6.3	0.200	6.9	0.400	6.6	0.600	5.5	1.000	7.0																																																
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Horsley House Regent Centre, Gosforth Newcastle upon Tyne NE3 3LU		Greenhead Proposed					
Date 09/11/2021 File GREENHEAD MODEL_D.MDX		Designed by MAK Checked by MLC					
Micro Drainage		Network 2020.1					
<u>Hydro-Brake® Optimum Manhole: SW 08, DS/PN: 11.004, Volume (m³): 4.1</u>							
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
1.200	7.6	2.400	10.5	5.000	14.9	8.000	18.6
1.400	8.2	2.600	10.9	5.500	15.6	8.500	19.2
1.600	8.7	3.000	11.7	6.000	16.2	9.000	19.7
1.800	9.2	3.500	12.6	6.500	16.9	9.500	20.2
2.000	9.7	4.000	13.4	7.000	17.5		
2.200	10.1	4.500	14.2	7.500	18.1		
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Storage Structures for Storm Porous Car Park Manhole: SW 15, DS/PN: 1.000 <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00250</td><td>Width (m)</td><td>31.0</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Length (m)</td><td>21.7</td></tr><tr><td>Max Percolation (l/s)</td><td>186.9</td><td>Slope (1:X)</td><td>0.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Depression Storage (mm)</td><td>5</td></tr><tr><td>Porosity</td><td>0.30</td><td>Evaporation (mm/day)</td><td>3</td></tr><tr><td>Invert Level (m)</td><td>129.995</td><td>Cap Volume Depth (m)</td><td>0.450</td></tr></table> Porous Car Park Manhole: SW 16, DS/PN: 2.000 <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00250</td><td>Width (m)</td><td>31.0</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Length (m)</td><td>16.0</td></tr><tr><td>Max Percolation (l/s)</td><td>137.8</td><td>Slope (1:X)</td><td>0.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Depression Storage (mm)</td><td>5</td></tr><tr><td>Porosity</td><td>0.30</td><td>Evaporation (mm/day)</td><td>3</td></tr><tr><td>Invert Level (m)</td><td>130.605</td><td>Cap Volume Depth (m)</td><td>0.450</td></tr></table> Tank or Pond Manhole: PITCH, DS/PN: 3.000 <table><tr><td colspan="2">Invert Level (m) 129.895</td></tr><tr><td>Depth (m)</td><td>Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td></tr><tr><td>0.000</td><td>2275.0</td><td>0.300</td><td>2275.0</td><td>0.301</td><td>0.0</td></tr></table> Porous Car Park Manhole: SW 17, DS/PN: 1.001 <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00250</td><td>Width (m)</td><td>31.0</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Length (m)</td><td>24.0</td></tr><tr><td>Max Percolation (l/s)</td><td>206.7</td><td>Slope (1:X)</td><td>0.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Depression Storage (mm)</td><td>5</td></tr><tr><td>Porosity</td><td>0.30</td><td>Evaporation (mm/day)</td><td>3</td></tr><tr><td>Invert Level (m)</td><td>130.355</td><td>Cap Volume Depth (m)</td><td>0.450</td></tr></table> Porous Car Park Manhole: SW 09, DS/PN: 9.000 <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Width (m)</td><td>4.0</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Length (m)</td><td>60.5</td></tr><tr><td>Max Percolation (l/s)</td><td>67.2</td><td>Slope (1:X)</td><td>0.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Depression Storage (mm)</td><td>5</td></tr><tr><td>Porosity</td><td>0.30</td><td>Evaporation (mm/day)</td><td>3</td></tr><tr><td>Invert Level (m)</td><td>120.605</td><td>Cap Volume Depth (m)</td><td>0.450</td></tr></table> Porous Car Park Manhole: SW 12, DS/PN: 9.003 <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Safety Factor</td><td>2.0</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Porosity</td><td>0.30</td></tr><tr><td>Max Percolation (l/s)</td><td>21.7</td><td>Invert Level (m)</td><td>120.600</td></tr></table>			Infiltration Coefficient Base (m/hr)	0.00250	Width (m)	31.0	Membrane Percolation (mm/hr)	1000	Length (m)	21.7	Max Percolation (l/s)	186.9	Slope (1:X)	0.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	129.995	Cap Volume Depth (m)	0.450	Infiltration Coefficient Base (m/hr)	0.00250	Width (m)	31.0	Membrane Percolation (mm/hr)	1000	Length (m)	16.0	Max Percolation (l/s)	137.8	Slope (1:X)	0.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	130.605	Cap Volume Depth (m)	0.450	Invert Level (m) 129.895		Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	2275.0	0.300	2275.0	0.301	0.0	Infiltration Coefficient Base (m/hr)	0.00250	Width (m)	31.0	Membrane Percolation (mm/hr)	1000	Length (m)	24.0	Max Percolation (l/s)	206.7	Slope (1:X)	0.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	130.355	Cap Volume Depth (m)	0.450	Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	4.0	Membrane Percolation (mm/hr)	1000	Length (m)	60.5	Max Percolation (l/s)	67.2	Slope (1:X)	0.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	120.605	Cap Volume Depth (m)	0.450	Infiltration Coefficient Base (m/hr)	0.00000	Safety Factor	2.0	Membrane Percolation (mm/hr)	1000	Porosity	0.30	Max Percolation (l/s)	21.7	Invert Level (m)	120.600
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Date 09/11/2021 File GREENHEAD MODEL_D.MDX	Designed by MAK Checked by MLC													
Micro Drainage Network 2020.1														
Tank or Pond Manhole: TANK, DS/PN: 11.003 Invert Level (m) 122.340 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>310.0</td><td>0.800</td><td>310.0</td><td>0.801</td><td>0.0</td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	310.0	0.800	310.0	0.801	0.0
Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)									
0.000	310.0	0.800	310.0	0.801	0.0									
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Greenhead Proposed

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Micro Drainage

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1 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 0.000

Hot Start (mins) 0

MADD Factor * 10m³/ha Storage 6.000

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 Storage Structures 12

Number of Online Controls 3

Number of Time/Area Diagrams 0

Number of Offline Controls 0

Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR

Ratio R 0.286

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

Return Period(s) (years) 1, 30, 100

Climate Change (%) 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	SW 15	480 Winter	1	+0%	100/60 Summer			
2.000	SW 16	120 Winter	1	+0%	1/60 Winter			
3.000	PITCH	1440 Winter	1	+0%				
1.001	SW 17	120 Winter	1	+0%	1/30 Winter			
1.002	EX MH 40	120 Winter	1	+0%	1/30 Winter			
4.000	EX MH 18	15 Summer	1	+0%	100/15 Summer			
5.000	EX MH INT	15 Winter	1	+0%	30/15 Summer	100/15 Summer		
4.001	EX MH 19	15 Winter	1	+0%	30/15 Summer			
4.002	EX MH 20	15 Winter	1	+0%	30/15 Summer			
4.003	EX MH22	15 Winter	1	+0%	30/15 Summer			
6.000	EX MH 25	15 Winter	1	+0%	100/15 Summer			
4.004	EX MH 24	15 Winter	1	+0%	1/15 Summer			
7.000	EX MH 29	15 Winter	1	+0%	30/15 Summer			
7.001	CO 01	15 Winter	1	+0%	30/15 Summer			
8.000	EX MH 04	15 Summer	1	+0%	100/15 Winter			
7.002	CO 02	15 Winter	1	+0%	1/15 Summer			
9.000	SW 09	180 Summer	1	+0%	30/30 Winter			
9.001	SW 10	120 Winter	1	+0%	30/15 Summer			

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Micro Drainage

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	SW 15	130.026	-0.074	0.000	0.15	241	0.6	OK
2.000	SW 16	130.062	0.047	0.000	0.49	19	2.3	SURCHARGED
3.000	PITCH	129.916	-0.129	0.000	0.05		0.8	OK
1.001	SW 17	130.045	0.125	0.000	0.59	28	2.6	SURCHARGED
1.002	EX MH 40	130.035	0.095	0.000	0.13		2.1	SURCHARGED
4.000	EX MH 18	127.023	-0.117	0.000	0.11		2.9	OK
5.000	EX MH INT	127.056	-0.084	0.000	0.39		6.6	OK
4.001	EX MH 19	126.756	-0.064	0.000	0.61		12.2	OK
4.002	EX MH 20	126.169	-0.061	0.000	0.65		16.6	OK
4.003	EX MH22	125.981	-0.069	0.000	0.56		16.6	OK
6.000	EX MH 25	126.203	-0.117	0.000	0.11		2.6	OK
4.004	EX MH 24	125.666	0.036	0.000	1.13		23.1	SURCHARGED
7.000	EX MH 29	121.922	-0.068	0.000	0.58		10.9	OK
7.001	CO 01	121.044	-0.056	0.000	0.71		15.7	OK
8.000	EX MH 04	123.349	-0.111	0.000	0.15		7.3	OK
7.002	CO 02	120.833	0.033	0.000	0.94		21.6	SURCHARGED
9.000	SW 09	120.582	-0.068	0.000	0.22	23	0.8	OK
9.001	SW 10	120.530	-0.005	0.000	0.33		1.1	OK

PN

US/MH Name

Level Exceeded

1.000

SW 15

2.000

SW 16

3.000

PITCH

1.001

SW 17

1.002

EX MH 40

4.000

EX MH 18

5.000

EX MH INT

5

4.001

EX MH 19

4.002

EX MH 20

4.003

EX MH22

6.000

EX MH 25

4.004

EX MH 24

7.000

EX MH 29

7.001

CO 01

8.000

EX MH 04

7.002

CO 02

9.000

SW 09

9.001

SW 10

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

for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
9.002	SW 11	120 Winter	1	+0%	1/15 Summer			
9.003	SW 12	120 Winter	1	+0%	1/15 Summer			
10.000	SW 13	120 Winter	1	+0%	1/15 Summer			
9.004	SW 14	120 Winter	1	+0%	1/15 Summer			
7.003	CO 03	15 Winter	1	+0%	1/15 Summer			
11.000	SW 01	15 Winter	1	+0%				
11.001	SW 02	15 Winter	1	+0%				
12.000	SW 03	30 Summer	1	+0%	30/15 Summer			
12.001	SW 04	30 Winter	1	+0%	1/15 Summer			
13.000	SW 05	60 Winter	1	+0%	1/30 Summer			
12.002	SW 06	60 Winter	1	+0%	1/15 Winter			
11.002	SW 07	15 Winter	1	+0%				
11.003	TANK	240 Winter	1	+0%	100/60 Winter			
11.004	SW 08	240 Winter	1	+0%	1/60 Summer			
14.000	EX MH 13	15 Winter	1	+0%	30/15 Summer	100/15 Winter		
14.001	EX MH 14	15 Winter	1	+0%	30/15 Summer			
14.002	EX MH 16	15 Winter	1	+0%				
14.003	EX MH 46	15 Winter	1	+0%	100/15 Summer			
14.004	EX MH 11	15 Winter	1	+0%	100/15 Summer			
14.005	EX MH 07	15 Winter	1	+0%	30/15 Summer			
11.005	EX MH 08	15 Winter	1	+0%	30/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
9.002	SW 11	120.518	0.078	0.000	0.35			1.2	SURCHARGED
9.003	SW 12	120.508	0.113	0.000	0.42		26	1.4	SURCHARGED
10.000	SW 13	120.495	0.145	0.000	0.16			0.5	SURCHARGED
9.004	SW 14	120.492	0.172	0.000	0.57		35	2.2	SURCHARGED
7.003	CO 03	120.437	0.092	0.000	1.24			20.6	SURCHARGED
11.000	SW 01	123.238	-0.217	0.000	0.17			10.0	OK
11.001	SW 02	123.199	-0.276	0.000	0.16			16.8	OK
12.000	SW 03	125.790	-0.060	0.000	0.32		5	3.7	OK
12.001	SW 04	125.089	0.364	0.000	1.15		8	6.1	SURCHARGED
13.000	SW 05	124.147	0.222	0.000	1.38		12	1.7	SURCHARGED
12.002	SW 06	124.089	0.284	0.000	1.17		12	7.2	SURCHARGED
11.002	SW 07	123.119	-0.256	0.000	0.22			22.1	OK
11.003	TANK	122.466	-0.249	0.000	0.06			5.3	OK
11.004	SW 08	122.463	0.058	0.000	0.47			5.3	SURCHARGED
14.000	EX MH 13	126.188	-0.042	0.000	0.61			4.0	OK
14.001	EX MH 14	125.985	-0.025	0.000	0.91			5.9	OK
14.002	EX MH 16	125.834	-0.096	0.000	0.28			7.9	OK
14.003	EX MH 46	125.582	-0.098	0.000	0.26			10.2	OK
14.004	EX MH 11	124.344	-0.086	0.000	0.37			12.5	OK
14.005	EX MH 07	123.339	-0.071	0.000	0.54			12.5	OK
11.005	EX MH 08	122.361	-0.039	0.000	0.90			12.3	OK

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PN	US/MH Name	Level Exceeded																																																																		
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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 0.000

Hot Start (mins) 0

MADD Factor * 10m³/ha Storage 6.000

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 Storage Structures 12

Number of Online Controls 3

Number of Time/Area Diagrams 0

Number of Offline Controls 0

Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR

Ratio R 0.286

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

Return Period(s) (years) 1, 30, 100

Climate Change (%) 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	SW 15	240 Winter	30	+0%	100/60 Summer			
2.000	SW 16	30 Winter	30	+0%	1/60 Winter			
3.000	PITCH	960 Winter	30	+0%				
1.001	SW 17	15 Winter	30	+0%	1/30 Winter			
1.002	EX MH 40	30 Summer	30	+0%	1/30 Winter			
4.000	EX MH 18	15 Winter	30	+0%	100/15 Summer			
5.000	EX MH INT	15 Winter	30	+0%	30/15 Summer	100/15 Summer		
4.001	EX MH 19	15 Winter	30	+0%	30/15 Summer			
4.002	EX MH 20	15 Winter	30	+0%	30/15 Summer			
4.003	EX MH22	15 Winter	30	+0%	30/15 Summer			
6.000	EX MH 25	15 Winter	30	+0%	100/15 Summer			
4.004	EX MH 24	15 Winter	30	+0%	1/15 Summer			
7.000	EX MH 29	15 Winter	30	+0%	30/15 Summer			
7.001	CO 01	15 Winter	30	+0%	30/15 Summer			
8.000	EX MH 04	15 Winter	30	+0%	100/15 Winter			
7.002	CO 02	15 Winter	30	+0%	1/15 Summer			
9.000	SW 09	180 Winter	30	+0%	30/30 Winter			
9.001	SW 10	120 Winter	30	+0%	30/15 Summer			

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	SW 15	130.082	-0.018	0.000	0.58	108	2.4	OK
2.000	SW 16	130.467	0.452	0.000	1.83	8	8.6	SURCHARGED
3.000	PITCH	129.955	-0.090	0.000	0.13		2.0	OK
1.001	SW 17	130.180	0.260	0.000	1.52	15	6.6	SURCHARGED
1.002	EX MH 40	130.170	0.230	0.000	0.13		2.1	SURCHARGED
4.000	EX MH 18	127.122	-0.018	0.000	0.27		7.0	OK
5.000	EX MH INT	127.209	0.069	0.000	0.78		13.3	SURCHARGED
4.001	EX MH 19	127.108	0.288	0.000	0.96		19.3	SURCHARGED
4.002	EX MH 20	126.614	0.384	0.000	1.04		26.7	SURCHARGED
4.003	EX MH22	126.419	0.369	0.000	0.93		27.7	SURCHARGED
6.000	EX MH 25	126.223	-0.097	0.000	0.27		6.4	OK
4.004	EX MH 24	126.110	0.480	0.000	2.06		42.0	SURCHARGED
7.000	EX MH 29	122.600	0.610	0.000	1.04		19.5	SURCHARGED
7.001	CO 01	122.283	1.183	0.000	1.08		24.1	SURCHARGED
8.000	EX MH 04	123.373	-0.087	0.000	0.37		17.9	OK
7.002	CO 02	121.925	1.125	0.000	1.51		34.8	SURCHARGED
9.000	SW 09	120.707	0.057	0.000	0.56	67	1.9	SURCHARGED
9.001	SW 10	120.731	0.196	0.000	0.60		2.0	FLOOD RISK

PN	US/MH Name	Level Exceeded
1.000	SW 15	
2.000	SW 16	
3.000	PITCH	
1.001	SW 17	
1.002	EX MH 40	
4.000	EX MH 18	
5.000	EX MH INT	5
4.001	EX MH 19	
4.002	EX MH 20	
4.003	EX MH22	
6.000	EX MH 25	
4.004	EX MH 24	
7.000	EX MH 29	
7.001	CO 01	
8.000	EX MH 04	
7.002	CO 02	
9.000	SW 09	
9.001	SW 10	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
9.002	SW 11	60 Winter	30	+0%	1/15 Summer			
9.003	SW 12	60 Winter	30	+0%	1/15 Summer			
10.000	SW 13	30 Summer	30	+0%	1/15 Summer			
9.004	SW 14	30 Winter	30	+0%	1/15 Summer			
7.003	CO 03	15 Winter	30	+0%	1/15 Summer			
11.000	SW 01	15 Winter	30	+0%				
11.001	SW 02	15 Winter	30	+0%				
12.000	SW 03	30 Winter	30	+0%	30/15 Summer			
12.001	SW 04	60 Winter	30	+0%	1/15 Summer			
13.000	SW 05	60 Winter	30	+0%	1/30 Summer			
12.002	SW 06	120 Winter	30	+0%	1/15 Winter			
11.002	SW 07	15 Winter	30	+0%				
11.003	TANK	360 Winter	30	+0%	100/60 Winter			
11.004	SW 08	360 Winter	30	+0%	1/60 Summer			
14.000	EX MH 13	15 Winter	30	+0%	30/15 Summer	100/15 Winter		
14.001	EX MH 14	15 Winter	30	+0%	30/15 Summer			
14.002	EX MH 16	15 Winter	30	+0%				
14.003	EX MH 46	15 Winter	30	+0%	100/15 Summer			
14.004	EX MH 11	15 Winter	30	+0%	100/15 Summer			
14.005	EX MH 07	15 Winter	30	+0%	30/15 Summer			
11.005	EX MH 08	15 Winter	30	+0%	30/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Overflow Cap.	Half Drain Time (mins)	Pipe Flow (l/s)	Status
9.002	SW 11	120.769	0.329	0.000	0.77		2.6	SURCHARGED
9.003	SW 12	120.781	0.386	0.000	0.61	30	2.0	SURCHARGED
10.000	SW 13	120.837	0.487	0.000	0.95		3.0	SURCHARGED
9.004	SW 14	120.810	0.490	0.000	0.57	10	2.2	SURCHARGED
7.003	CO 03	120.881	0.536	0.000	2.01		33.3	SURCHARGED
11.000	SW 01	123.301	-0.154	0.000	0.41		24.5	OK
11.001	SW 02	123.271	-0.204	0.000	0.42		45.1	OK
12.000	SW 03	125.962	0.112	0.000	0.59	6	7.0	SURCHARGED
12.001	SW 04	125.848	1.123	0.000	1.35	20	7.2	SURCHARGED
13.000	SW 05	124.715	0.790	0.000	2.35	17	2.9	SURCHARGED
12.002	SW 06	124.246	0.441	0.000	1.26	27	7.7	SURCHARGED
11.002	SW 07	123.192	-0.183	0.000	0.52		52.2	OK
11.003	TANK	122.679	-0.036	0.000	0.09		7.7	OK
11.004	SW 08	122.670	0.265	0.000	0.61		6.9	SURCHARGED
14.000	EX MH 13	126.397	0.167	0.000	0.96		6.4	SURCHARGED
14.001	EX MH 14	126.197	0.187	0.000	1.57		10.1	SURCHARGED
14.002	EX MH 16	125.861	-0.069	0.000	0.55		15.4	OK
14.003	EX MH 46	125.613	-0.067	0.000	0.57		22.6	OK
14.004	EX MH 11	124.403	-0.027	0.000	0.89		29.6	OK
14.005	EX MH 07	123.641	0.231	0.000	1.24		28.6	SURCHARGED
11.005	EX MH 08	122.651	0.251	0.000	1.63		22.4	SURCHARGED

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Horsley House Regent Centre, Gosforth Newcastle upon Tyne NE3 3LU	Greenhead Proposed																																																																			
Date 09/11/2021 File GREENHEAD MODEL_D.MDX	Designed by MAK Checked by MLC																																																																			
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<u>30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)</u> <u>for Storm</u>																																																																				
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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 0.000

Hot Start (mins) 0

MADD Factor * 10m³/ha Storage 6.000

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 Storage Structures 12

Number of Online Controls 3

Number of Time/Area Diagrams 0

Number of Offline Controls 0

Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR

Ratio R 0.286

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

Return Period(s) (years) 1, 30, 100

Climate Change (%) 0, 0, 30

PN

US/MH Name

Storm

Return Period

Climate Change

First (X) Surcharge

First (Y) Flood

First (Z) Overflow

Overflow Act.

1.000

SW 15

180 Winter

100

+30%

100/60 Summer

2.000

SW 16

30 Winter

100

+30%

1/60 Winter

3.000

PITCH

960 Winter

100

+30%

1.001

SW 17

15 Winter

100

+30%

1/30 Winter

1.002

EX MH 40

15 Winter

100

+30%

1/30 Winter

4.000

EX MH 18

15 Winter

100

+30%

100/15 Summer

5.000

EX MH INT

30 Winter

100

+30%

30/15 Summer

100/15 Summer

4.001

EX MH 19

15 Winter

100

+30%

30/15 Summer

4.002

EX MH 20

15 Winter

100

+30%

30/15 Summer

4.003

EX MH22

15 Winter

100

+30%

30/15 Summer

6.000

EX MH 25

15 Winter

100

+30%

100/15 Summer

4.004

EX MH 24

15 Winter

100

+30%

1/15 Summer

7.000

EX MH 29

15 Winter

100

+30%

30/15 Summer

7.001

CO 01

15 Winter

100

+30%

30/15 Summer

8.000

EX MH 04

15 Winter

100

+30%

100/15 Winter

7.002

CO 02

15 Winter

100

+30%

1/15 Summer

9.000

SW 09

240 Winter

100

+30%

30/30 Winter

9.001

SW 10

30 Summer

100

+30%

30/15 Summer

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Horsley House Regent Centre, Gosforth Newcastle upon Tyne NE3 3LU	Greenhead Proposed	
Date 09/11/2021 File GREENHEAD MODEL_D.MDX	Designed by MAK Checked by MLC	
Micro Drainage		Network 2020.1

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	SW 15	130.149	0.049	0.000	0.70	119	2.9	SURCHARGED
2.000	SW 16	130.625	0.610	0.000	2.28	8	10.7	SURCHARGED
3.000	PITCH	130.015	-0.030	0.000	0.14		2.2	OK
1.001	SW 17	130.356	0.436	0.000	1.87	18	8.1	SURCHARGED
1.002	EX MH 40	130.351	0.411	0.000	0.14		2.2	SURCHARGED
4.000	EX MH 18	127.643	0.503	0.000	0.34		9.0	FLOOD RISK
5.000	EX MH INT	127.603	0.463	2.704	0.91		15.4	FLOOD
4.001	EX MH 19	127.611	0.791	0.000	1.12		22.4	FLOOD RISK
4.002	EX MH 20	127.216	0.986	0.000	1.18		30.2	SURCHARGED
4.003	EX MH22	126.958	0.908	0.000	1.06		31.4	SURCHARGED
6.000	EX MH 25	126.584	0.264	0.000	0.34		8.0	SURCHARGED
4.004	EX MH 24	126.535	0.905	0.000	2.66		54.3	SURCHARGED
7.000	EX MH 29	124.431	2.441	0.000	1.10		20.5	SURCHARGED
7.001	CO 01	123.831	2.731	0.000	1.40		31.2	SURCHARGED
8.000	EX MH 04	123.490	0.030	0.000	0.60		28.8	SURCHARGED
7.002	CO 02	123.242	2.442	0.000	2.02		46.4	SURCHARGED
9.000	SW 09	120.850	0.200	0.000	0.56	149	1.9	SURCHARGED
9.001	SW 10	120.853	0.318	0.000	0.37		1.2	FLOOD RISK

PN	US/MH Name	Level Exceeded
1.000	SW 15	
2.000	SW 16	
3.000	PITCH	
1.001	SW 17	
1.002	EX MH 40	
4.000	EX MH 18	
5.000	EX MH INT	5
4.001	EX MH 19	
4.002	EX MH 20	
4.003	EX MH22	
6.000	EX MH 25	
4.004	EX MH 24	
7.000	EX MH 29	
7.001	CO 01	
8.000	EX MH 04	
7.002	CO 02	
9.000	SW 09	
9.001	SW 10	

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Regent Centre, Gosforth
Newcastle upon Tyne NE3 3LU

Date 09/11/2021
File GREENHEAD MODEL_D.MDX

Micro Drainage

Greenhead Proposed

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Network 2020.1

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.
9.002	SW 11	120 Winter	100	+30%	1/15 Summer			
9.003	SW 12	60 Winter	100	+30%	1/15 Summer			
10.000	SW 13	15 Winter	100	+30%	1/15 Summer			
9.004	SW 14	60 Winter	100	+30%	1/15 Summer			
7.003	CO 03	15 Winter	100	+30%	1/15 Summer			
11.000	SW 01	15 Winter	100	+30%				
11.001	SW 02	15 Winter	100	+30%				
12.000	SW 03	60 Winter	100	+30%	30/15 Summer			
12.001	SW 04	60 Winter	100	+30%	1/15 Summer			
13.000	SW 05	120 Winter	100	+30%	1/30 Summer			
12.002	SW 06	240 Winter	100	+30%	1/15 Winter			
11.002	SW 07	15 Winter	100	+30%				
11.003	TANK	480 Winter	100	+30%	100/60 Winter			
11.004	SW 08	480 Winter	100	+30%	1/60 Summer			
14.000	EX MH 13	15 Winter	100	+30%	30/15 Summer	100/15 Winter		
14.001	EX MH 14	15 Winter	100	+30%	30/15 Summer			
14.002	EX MH 16	15 Winter	100	+30%				
14.003	EX MH 46	15 Winter	100	+30%	100/15 Summer			
14.004	EX MH 11	15 Winter	100	+30%	100/15 Summer			
14.005	EX MH 07	15 Winter	100	+30%	30/15 Summer			
11.005	EX MH 08	15 Winter	100	+30%	30/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
9.002	SW 11	120.888	0.448	0.000	0.61			2.0	SURCHARGED
9.003	SW 12	120.893	0.498	0.000	0.44			1.5	SURCHARGED
10.000	SW 13	120.961	0.611	0.000	2.15			6.7	SURCHARGED
9.004	SW 14	120.902	0.582	0.000	0.57		47	2.2	SURCHARGED
7.003	CO 03	121.407	1.062	0.000	2.65			43.9	FLOOD RISK
11.000	SW 01	123.369	-0.086	0.000	0.68			41.0	OK
11.001	SW 02	123.337	-0.138	0.000	0.70			75.7	OK
12.000	SW 03	126.061	0.211	0.000	0.45		27	5.3	SURCHARGED
12.001	SW 04	126.052	1.327	0.000	1.40		47	7.5	SURCHARGED
13.000	SW 05	124.759	0.834	0.000	2.35		49	2.9	SURCHARGED
12.002	SW 06	124.405	0.600	0.000	1.35		44	8.2	SURCHARGED
11.002	SW 07	123.260	-0.115	0.000	0.82			82.5	OK
11.003	TANK	123.017	0.302	0.000	0.15			13.4	SURCHARGED
11.004	SW 08	123.069	0.664	0.000	0.61			6.9	SURCHARGED
14.000	EX MH 13	126.760	0.530	0.228	1.29			8.5	FLOOD
14.001	EX MH 14	126.472	0.462	0.000	2.07			13.4	FLOOD RISK
14.002	EX MH 16	125.921	-0.009	0.000	0.80			22.2	OK
14.003	EX MH 46	125.798	0.118	0.000	0.79			31.3	SURCHARGED
14.004	EX MH 11	125.170	0.740	0.000	1.09			36.4	SURCHARGED
14.005	EX MH 07	123.986	0.576	0.000	1.56			35.8	SURCHARGED
11.005	EX MH 08	122.910	0.510	0.000	2.09			28.6	SURCHARGED

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6.9 Appendix 9 – Flood Exceedance Plan



1029730

A1

Based on:
Architects Drg No.
Structural Drg No.
Survey Drg No.
Other Drg No.
Other Drg No.

Rev
Rev
Rev
Rev
Rev

Notes

1. THE ARROWS ON THIS DRAWING INDICATE OVERLAND FLOW DIRECTION DU TO SYSTEM FAILURE
2. DRAWING TO BE READ IN CONJUNCTION WITH OTHER DRAINAGE DRAWINGS

P02	23.11.21	SITE LAYOUT UPDATED	MAK	MLC	MLC
P01	10.11.21	ISSUED FOR INFORMATION	EH	MAK	MLC
Issue	Date	Description	By	Chkd	Verfd

Project

GREENHEAD COLLEGE
HUDDERSFIELD

Client

GALIFORD TRY

Architect

RYDER

Title

FLOOD EXCEEDANCE PLAN

Drawing No.	Drawing Status
NE8659-CCS-ZZ-XX-DR-D-0508	S2-INFORMATION
Job No.	Scale
1029730	1:500

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