WASTEWATER TREATMENT WORKS
BEESTON, NORWICH

FLOOD RISK ASSESSMENT

STRETTON BEESTON LTD

DOCUMENT REFERENCE:

22061-FRA-RP-02 | P01

WATER | ENVIRONMENT

Water Environment Limited
6 Coppergate Mews
103 Brighton Road
Surbiton
London
KT6 5NE

Tel: 020 8545 9720

www.WaterEnvironment.co.uk

Authorisation and Version Control

Water Environment was commissioned by Stretton Beeston Ltd to investigate the risks and assess the consequences of flooding on the site at the Beeston Waste Water Treatment Works as well as to develop a Sustainable Drainage Strategy for the proposed development.

Author:	**Ewan Andrew** MSc, (Env Acoustics) BEng, (Civil)	
Checker:	**Gabriel Eve** MEng (Civil & Environmental)	
Approver:	**Guy Laister** Director/Associate	

for and on behalf of Water Environment Limited

Document Version History

Rev	Date	Comments	Auth	Chck	Appr
P01	11/04/2024	First issue	EA	GE	GL

CONTENTS

List of Figures

List of Tables

EXECUTIVE SUMMARY

The site under consideration within this Flood Risk Assessment is known as the Beeston Park site. The site is located to the north of the A1270 Broadland Northway, to the west of the town of Rackheath and lies within the jurisdiction of the Norfolk County Council. Currently, the site is not occupied having previously been used as agricultural land for grazing and the proposed development is to create a wastewater treatment works.

The application site is approximately 2.56 ha in size and a Flood Risk Assessment has therefore been prepared to accompany a planning application for the site in accordance with the NPPF.

The site is shown to lie within Flood Zone 1 on the Environment Agency's latest Flood Map for Planning; however, it is partially within the assumed floodplain of the Dobbs' Beck (a tributary of the River Bure) which flows to the east of the site in a northerly direction. Detailed flood level information is not available from the Environment Agency as the Dobbs' Beck is not a 'main river'. The Dobbs' Beck is under the jurisdiction of the Norfolk Rivers Internal Drainage Board who have confirmed that no detailed hydraulic modelling of the Dobbs' Beck is available.

The proposed wastewater treatment works development is classified as 'water compatible', the wastewater treatment works would therefore be a compatible land use for any flood zone classification.

There are no receptors that could be vulnerable to increased flood risk within proximity of the site. The impact on flood risk to surrounding properties due to the loss in floodplain storage as a result of the proposed development is considered negligible.

The drainage system for the proposed development should reduce surface water rates to greenfield runoff rate in accordance with NCC drainage design standards. However, the calculated greenfield runoff rate is impractically low, resulting in very small hydro-brake controls and would therefore result in an unpractical risk of blockage. Therefore, the proposed SuDS strategy will reduce the runoff rate to 2 l/s for the 1 in 100 year + 40% CC rainfall event.

To achieve this rate of surface water discharge, a total volume of 516.6 m^3 of storage from deep crated storage and porous sub-base is required.

The Flood Risk Assessment concludes that the proposed development is safe from flooding from all sources. The impact on third-party landowners, as a result of the development, regarding flooding is considered to be negligible.

ABBREVIATIONS

Acronym	Definition
AOD	Above Ordnance Datum
BDC	Broadland District Council
BGL	Below Ground Level
BGS	British Geological Survey
DEFRA	Department for Environment Food and Rural Affairs
DTM	Digital Terrain Model
EA	Environment Agency
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
NCC	Norfolk County Council
PFRA	Preliminary Flood Risk Assessment
PPG	Planning Practice Guidance
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan

1 INTRODUCTION

General Information

1.1 The site, known as the Beeston Park wastewater treatment works, is located to the northeast of Norwich on a 2.56 ha plot of agricultural land. The site lies within the jurisdiction of Broadland District Council (BDC) which fulfils the role of Local Planning Authority (LPA) and Norfolk County Council (NCC) as the Lead Local Flood Authority (LLFA).

1.2 A wastewater treatment works at Beeston Park has been put forward in association with the proposed development at Beeston, downstream of the Rackheath Water Recycling Centre.

1.3 While the site is shown on the Environment Agency's latest Flood Map for Planning to lie within Flood Zone 1, it is located to the west of the Dobbs' Beck, which is an Internal Drainage Board (IDB) watercourse. The site is greater than 1 ha in size and a Flood Risk Assessment (FRA) is required to support a planning application.

Scope of Study

1.4 The main objectives of this study are to:

- Prepare an FRA in accordance with the National Planning Policy Framework (NPPF), associated Planning Practice Guidance for Flood Risk and Coastal Change, and Norfolk County Council (NCC) local planning policy;
- Assess the risk and implications of flooding on the site including flooding from tidal, fluvial, groundwater, surface water runoff and artificial sources;
- Provide advice on the site layout and design that will ensure the safe operation of the site in any flood event;
- Ensure that the risk of flooding to the surrounding area does not increase as a result of the proposed development;
- Consider the potential future impacts of climate change over the lifetime of the development.
- Develop a Sustainable Drainage Strategy that demonstrates how surface water runoff will be managed on the site, including calculations to demonstrate feasibility and other requirements as set out in the Non-Statutory Technical Standards for SuDS (NSTSS) and associated guidance; and
- Prepare a Flood Risk Assessment report for the proposed development, including a chapter for the drainage strategy, compliant with the guidelines set out in the NPPF and associated PPG as well as local policy requirements.

2 SITE DESCRIPTION

Location

2.1 The site is located to the north of Broadland Northway (A1270) in Beeston, Norfolk. The site is bounded to the east by the Dobbs' Beck and to the north, south and west by existing field boundaries, as shown in Figure 1. The access road to the site adjoins the B1150 to the west of the wastewater treatment works.

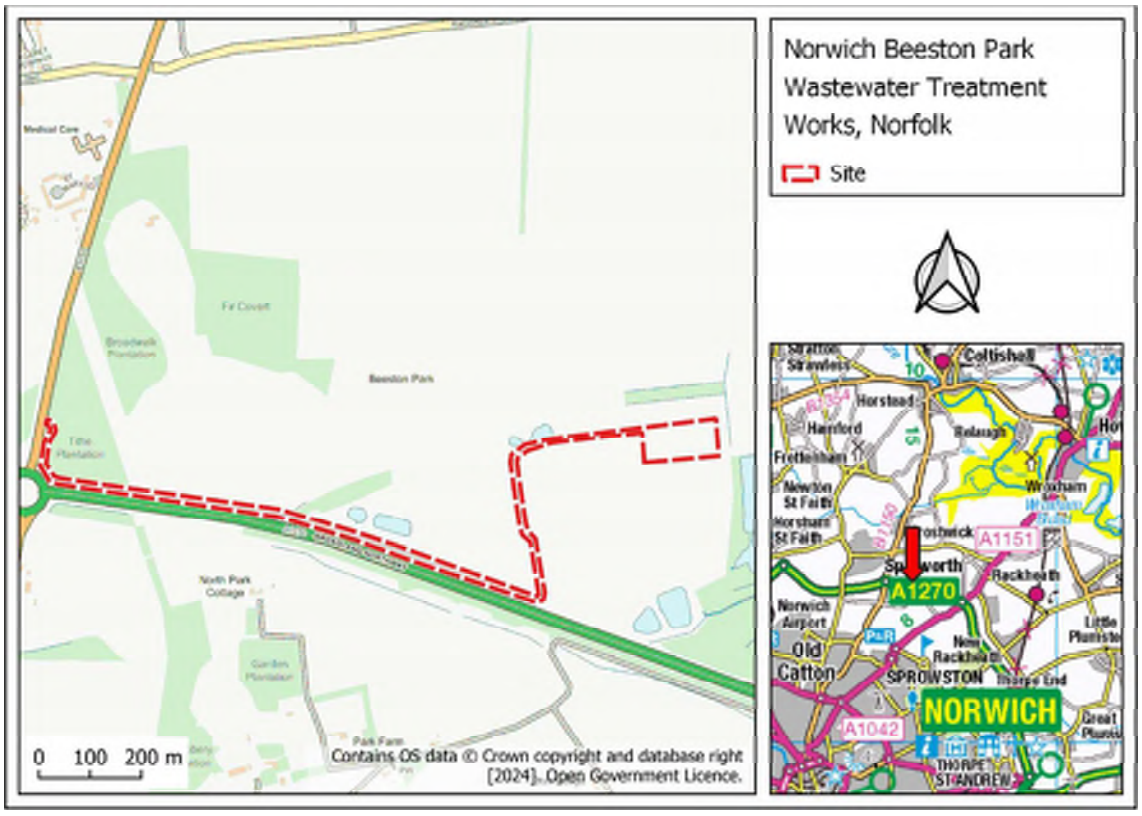

Figure 1: Site Location

Topographic Survey

2.2 A topographic survey was undertaken for the site by Rigour Survey in December 2023. Levels were surveyed in relation to the OSTN15 and OSGM15 datum (obtained by using GPS network) and levels are presented in metres Above Ordnance Datum (AOD). The survey is included in Appendix A of this report.

2.3 Surveyed levels on the site range from 10.48 m AOD in the north east corner of the application site, adjacent to the proposed wetland cells, to 17.16 m AOD at the south western end of the site.

2.4 The application site lies in an area of low ground in relation to the ground levels of the wider catchment area, as shown in Figure 2.

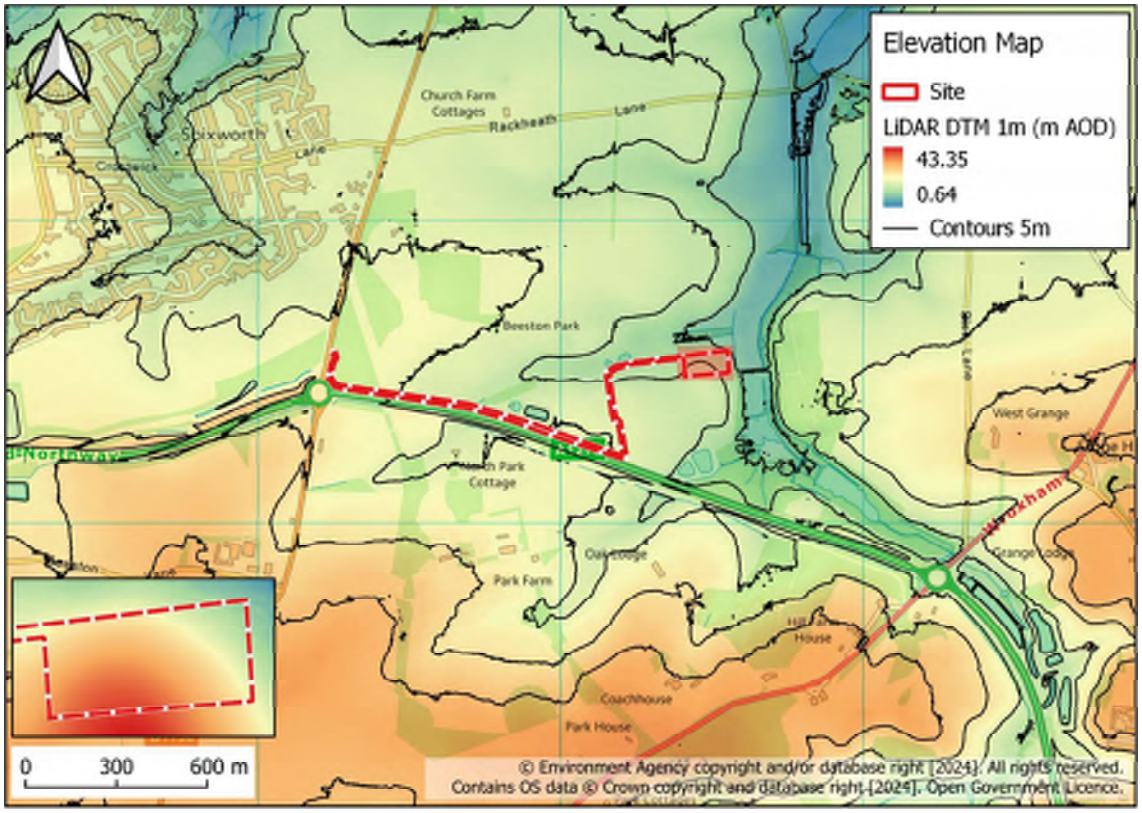

Figure 2: Elevation Map

Existing Development

2.5 The application site is approximately 2.56 ha in size. The site is entirely permeable and is currently unoccupied but had previously been used as pastureland.

Proposed Development

2.6 The proposed development includes a wastewater treatment works with four Te-Tech te-tyc tanks and new access road.

2.7 The site will undergo grading works as part of the proposed development. The application area will be set to a level of 13.80 m AOD with interfacing surrounding the fenced boundary set to a gradient of 1:3. The proposed interfacing will rise to the south and west and fall along the north and east edges of the fenced boundary.

2.8 The site is considered 'less vulnerable' development according to the flood risk vulnerability classification section of the National Planning Policy Framework[1].

[1] Department for Levelling Up, Housing & Communities and (December 2023), Revised National Planning Policy Framework

3 PLANNING POLICY

National Planning Policy Framework

3.1 The National Planning Policy Framework (NPPF) was revised in December 2023 and sets out the Government's planning policies for England and how these are expected to be applied. The NPPF States that:

> *"Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere."*

3.2 The accompanying Planning Practice Guidance (PPG) for Flood Risk and Coastal Change[2] clarifies which development types are considered appropriate within each flood zone. The Planning Practice guidance is updated on a regular, ongoing basis. Table 2 of the PPG confirms that water-compatible development is appropriate in Flood Zone 3a, and is acceptable in Flood Zone 3b (functional floodplain), provided it is designed and constructed to:

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

Sequential Test

3.3 The aim of the sequential test is to steer new development to areas with the lowest probability of flooding. Only where there are no reasonably available sites in Flood Zone 1, should sites in Flood Zone 2 and the Flood Zone 3 be considered. It is also important to consider the flood risk vulnerability of proposed land uses and, if required apply the exception test.

3.4 It is typically necessary for the function of water-compatible uses to be located nearby rivers. Since the proposed wastewater treatment works are intended specifically to treat nutrient-rich water from the Dobbs' Beck, there are no preferable site locations, and the Sequential Test is therefore passed.

Exception Test

3.5 The Exception Test, as detailed in the PPG, is only required for development in the following circumstances:

- Highly vulnerable and in Flood Zone 2;
- Essential infrastructure and in Flood Zone 3a or 3b; and
- More vulnerable development in Flood Zone 3a.

3.6 Therefore, as the development is classified as water-compatible, the Exception Test is not required in this case.

[2] Communities and Local Government (August 2022) Planning Practise Guidance: Flood Risk and Coastal Change

Local Planning Policy

3.7 The Norfolk County Council Core Strategy[3] was adopted in 2011 with the aim to set out planning policies in Norfolk over the 15 years to 2026. Policy DM3 – Groundwater and Surface Water states that:

> *A Flood Risk Assessment (FRA) must support all applications in areas of flood risk, and on sites greater than one hectare. The FRA should recognise the unique characteristics of minerals and waste sites which may adversely impact the water environment. These include, but are not limited to, the following:*
>
> - *Consideration of the impacts of the surface water and groundwater throughout the various phases of development;*
> - *Consideration of the impact on surface water and groundwater of all ancillary features such as bunds, stockpiles and roads;*
> - *Demonstration that mineral workings will not increase flood risk elsewhere, for example by adversely impacting on flood flows or storage capacity;*
> - *Details of how the site has been designed to reduce flood risk, for example with flood storage and attenuation areas;*
> - *Demonstration of how the risk of pollution will be minimised should the site flood;*
> - *Demonstration that the effectiveness of the floodplain will not be compromised, and, where possible, to reduce flood risk through appropriate design, operation and restoration;*
> - *Demonstration that the physical integrity of watercourses has been safeguarded by ensuring adequate margins between a river bank and an excavation.*

Strategic Flood Risk Assessment

3.8 The latest Strategic Flood Risk Assessment (SFRA)[4] report for BDC was completed by JBA consulting and published in November 2017. This report identifies significant areas of flood risk within BDC from all sources including fluvial, surface water, groundwater and sewer and drainage infrastructure.

3.9 The document provides key evidence and detailed mapping used to inform the site-specific flood risk assessment and is referenced throughout this report.

Preliminary Flood Risk Assessment and Surface Water Management Plan

3.10 The NCC Preliminary Flood Risk Assessment (PFRA)[5] was published in July 2011. The PFRA documents historic flooding and future flood risk in the borough and does not include any policy recommendations.

[3] Norfolk County Council, Core Strategy 2010-2026, Adopted 2011
[4] JBA consulting, Greater Norwich Area - Strategic Flood Risk Assessment, November 2017
[5] Norfolk County Council, Preliminary Flood Risk Assessment, July 2011

4 POTENTIAL FLOODING ON SITE

Historical Records of Flooding

4.1 The SFRA discusses historic flooding within the greater Norwich area. This discussion is focused on the Bure catchment, specifically in relation to flooding in the town of Rackheath.

4.2 The EA Historic Flood Map shows the maximum extent of all historical records held by the EA of flood outlines from rivers, the sea and groundwater springs and shows areas of land that have been previously subject to flooding in England. There are no records of flooding from any source at the site.

4.3 The SFRA was reviewed for DG5 records stating whether any surcharges or other relevant flooding incidents have been recorded in the area. The area of Rackheath has recorded 12 incidents of surcharging sewers since DG5 incidents were recorded up until the publication of the SFRA.

4.4 Section 19 Flood Investigation Reports published by the NCC were reviewed detailing flooding events of the winter 2020/21. Norfolk received an above average amount of rainfall throughout December, inundating the sewer system in the area and directing surface water runoff towards the affected properties. Two incidents of internal flooding were reported in the area.

4.5 No further Section 19 Flood Investigation Reports have been found at the time of writing which cover flood events at the site.

4.6 No further historic flood records have been identified.

Flooding from Rivers and the Sea

4.7 The site is located in close proximity to the Dobbs' Beck, a tributary of the River Bure, which flows past the site in a northerly direction. The site lies within Flood Zone 1 of the Flood Map for Planning; however, the Dobbs' Beck is not a main river and therefore the risk of flooding is not represented on these maps.

4.8 The Dobbs' Beck is an IDB watercourse, under the jurisdiction of Norfolk Rivers IDB. Flooding information was requested from them; however, they confirmed that there is no detailed hydraulic modelling available for the Dobbs' Beck.

4.9 In the absence of fluvial flood mapping of the Dobbs' Beck, the fluvial flooding aspect is discussed under the surface water flooding section of this report, which uses the Risk of Flooding From Surface Water mapping.

4.10 As the wastewater treatment works are designed to be flood resilient by their very nature they are not considered to be at significant risk from extreme fluvial or tidal flooding. It will however be necessary to undertake maintenance operations after a flood event, which should be specified by the designer/installer within the maintenance plan.

4.11 There are no receptors that could be vulnerable to increased flood risk within proximity of the site, therefore, an increase in flood risk to surrounding areas due to the loss in floodplain storage as a result of the proposed development would be considered negligible.

Flooding from Surface Water

4.12 Flooding from surface water can occur following intense local rainfall events when floodwater is unable to infiltrate into the ground or discharge into natural or artificial drainage infrastructure.

Floodwater subsequently follows the topography of the local area. Surface water flooding events are typically of a short duration but can be severe.

4.13 The Environment Agency has produced national scale mapping covering the risks of surface water flooding. These Environment Agency maps are a useful tool in assessing the extent and frequency of flooding in a general area but do come with a caveat that they should not be relied upon for site specific development or property level assessment. Engineering judgement is therefore required when considering the flood risk information presented.

4.14 Figure 3 illustrates the Risk of Flooding From Surface Water (RoFSW) extent map for the site and surrounding area. The dark blue shaded areas show locations of high surface water flood risk, which have a greater than 3.3% (1 in 30) annual probability of flooding, lighter blue areas show medium risk of between 3.3% and 1% (1 in 100) annual probability of flooding and the pale blue areas indicate low risk regions of between 1% and 0.1% (1 in 1000) annual probability of flooding. Areas that are not highlighted in blue are classed as having a very low risk of surface water flooding, with a less than 0.1% annual probability of flooding.

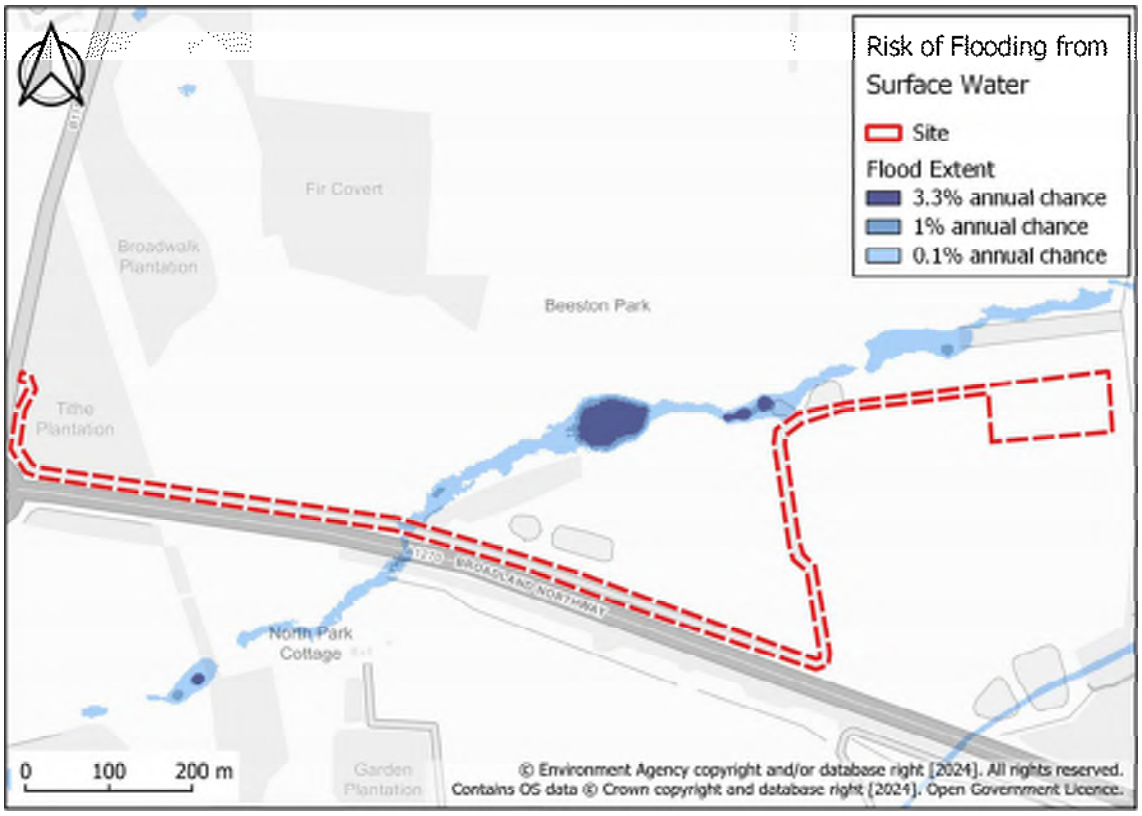

Figure 3: Risk of flooding from surface water - extent

4.15 The design event is the 1% AEP plus climate change event. It is important to note that surface water maps do not include future climate change, therefore it is common practice to evaluate the 1% AEP event as well as the 0.1% AEP event as a sensitivity test for what might happen in the future over the lifetime of the development. In this way it is possible to use the worst-case scenario (0.1% AEP) as an alternative for the design 1% AEP plus climate change event.

4.16 Figure 3 shows that the proposed area of development is entirely at 'very low' risk of flooding from surface water. A small section along the access road is shown to be at risk of surface water flooding during the low occurrence event; however, this would not increase the risk of flooding from surface water at the waste water treatment works.

4.17 The proposed development is therefore considered to be at low risk of surface water flooding.

Flooding from Sewers

4.18 Sewer flooding generally results in localised short-term flooding caused by intense rainfall events overloading the capacity of sewers.

4.19 There are no known sewers located on or nearby to the site. In the event of a failure of any sewage system nearby, the surrounding land generally slopes towards the site, such that any flow surcharging a private drainage system may drain towards the site.

4.20 Given that the development is considered as water compatible, the risk to the development from sewer flooding is low.

Flooding from Groundwater

4.21 Groundwater flooding occurs as a result of water rising up from an underlying aquifer or flowing from springs. This tends to occur after long periods of sustained high rainfall, and the areas at most risk are often low-lying where the water table is likely to be at shallow depth.

4.22 Groundwater flooding can interact with other sources of flooding, exacerbating their risk by reducing the infiltration of flood water to ground. The primary mechanisms for elevated groundwater at the site are associated with periods of above average rainfall in permeable superficial deposits and hydraulic continuity of these deposits with high river water levels.

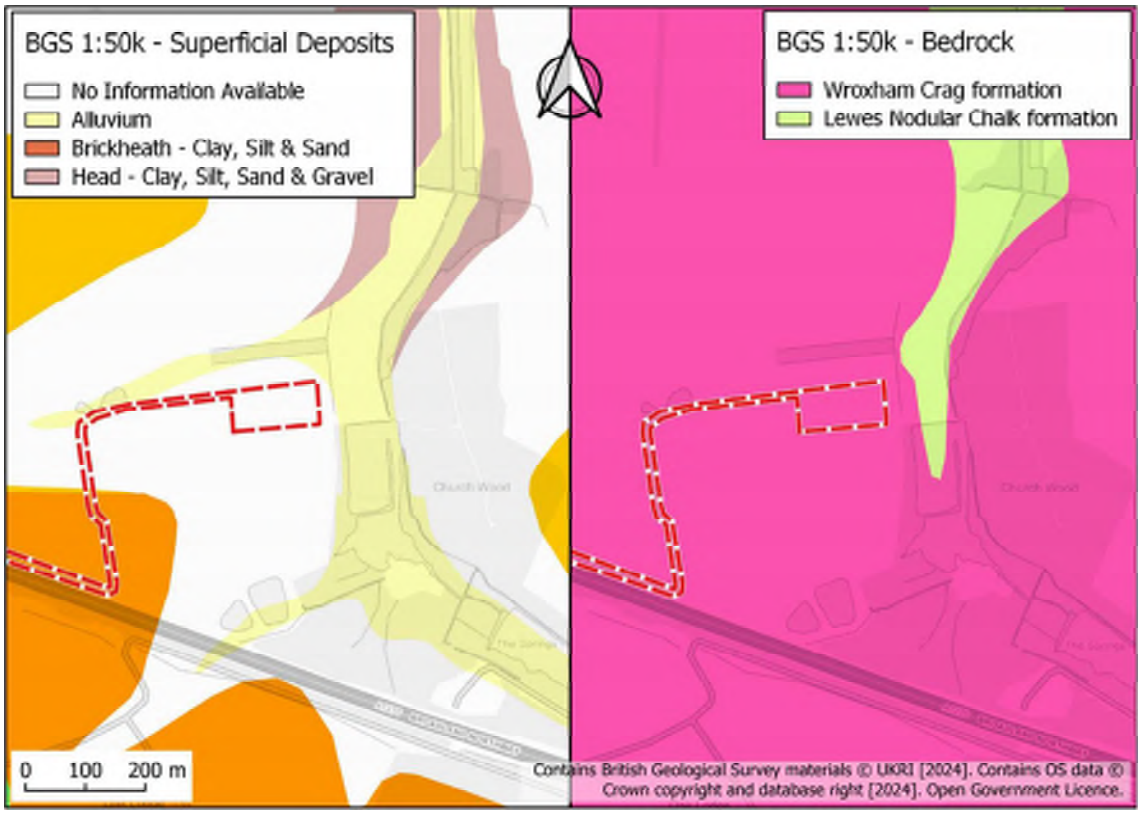

Figure 4: 1:50k Geology

4.23 The online 1:50k British Geology Society (BGS) map[6] indicates that the bedrock geology at the site location is the Wroxham Crag formation. The BGS map details that the site is not underlain by any superficial deposit layers, as shown in Figure 4.

4.24 The DEFRA Magic Maps[7] show that the bedrock layer has been designated as a 'Principal' aquifer, which is defined as '*layers of rock or drift deposits that have high intergranular and/or fracture permeability meaning they usually provide a high level of water storage'.*

4.25 The BGS GeoIndex Map[8] shows a borehole log (TG21SE177) is approximately 200 m to the south of the site. The log shows the geology to be made of gravelly clay followed by gravels and sand. The borehole was drilled to a depth of 4 m Below Ground Level (BGL) deep. Groundwater was discovered at a depth of 3 m BGL.

4.26 Groundwater levels do fluctuate due to seasonal variations and infiltrating surface water can cause local groundwater levels to rise. As such, water levels may rise sufficiently to reach the surface, where they would likely behave in a similar way to surface water flooding.

4.27 The main concern in relation to high levels of ground water is the exacerbation of fluvial flooding from the Dobbs' Beck. In this case it is not seen as appropriate to separate these causes of flood risk.

Flooding from Other Sources

4.28 The GOV.UK 'Risk of Flooding from Reservoirs' online map shows that the development location does not lie within an area affected by flooding in the event of the failure of reservoirs. This includes when there is a high rainfall event and local watercourses are suspectable to out of bank flooding.

4.29 The Environment Agency are the enforcement authority for the Reservoirs Act 1975 in England, they ensure that reservoirs are inspected regularly, and that all essential safety work is carried out. All reservoirs must be inspected and supervised by reservoir panel engineers. There has been no loss of life in the UK from reservoir flooding since 1925.

4.30 The site is not considered to be at risk of flooding from reservoirs.

[6] Available at: https://mapapps.bgs.ac.uk/geologyofbritain/home.html Accessed: 02/02/2024
[7] Available at: https://magic.defra.gov.uk/MagicMap.aspx accessed 02/02/2024
[8] https://mapapps2.bgs.ac.uk/geoindex/home.html Accessed 26/02/2024

5 SURFACE WATER MANAGEMENT

Policy

5.1 In accordance with the NPPF, surface water run-off rates and volumes should not increase from any site following development.

5.2 The NCC drainage design standards[9] require all schemes within the county to attenuate runoff to pre-development greenfield runoff rate and volumes for rainfall events up to and including the 100 year plus 40% climate change event.

Existing Site Drainage

5.3 The existing site is entirely undeveloped and considered "greenfield". The site boundary, excluding the access road, encloses an approximate area of 1.76 ha.

5.4 At the undeveloped site, rainwater drains to ground and in very heavy rainfall events rain will flow across the land and into the Dobbs' Beck.

Greenfield Runoff Rates

5.5 The greenfield runoff rate for the site was determined using the UK SuDS online tool and the FEH statistical runoff estimation approach.

5.6 The greenfield runoff rate has been calculated based on the proposed site drained area of 0.48 ha.

5.7 The access road leading to the new development has not been included in determining the greenfield runoff rate at the site as it will be drained as part of its own separate scheme.

5.8 The greenfield runoff rates, based on the proposed hardstanding area, are 0.28 l/s, 0.79 l/s and 1.15 l/s for the 1 year, 30 year and 100 year return periods, respectively.

Proposed Site Runoff

5.9 Local policy dictates that runoff rates are restricted to pre-development greenfield runoff rates. However, restricting runoff rates to greenfield may result in blockage from vegetation or other materials. It has therefore been proposed to restrict runoff rates to 2 l/s to ensure the drainage strategy does not incur blockages.

Discharge Strategy

5.10 The discharge strategy should also be considered, the Planning Practice Guidance states:

> *"Generally the aim should be discharge surface water runoff as high up the following hierarchy of drainage options as reasonably practicable:*
>
> 1. *Into the ground (infiltration);*
> 2. *To a surface water body;*
> 3. *To a surface water sewer, highway drain or another drainage system;*
> 4. *To a combined sewer."*

[9] https://www.norfolk.gov.uk/rubbish-recycling-and-planning/planning-applications/highway-guidance-for-development/drainage Accessed: 22/02/2024

5.11 The access road connecting to the site will be drained separately from the rest of the scheme with infiltration to ground proposed through the use of a filter drain.

5.12 We have investigated the possibility of draining surface water straight to ground via a formal soakaway. However, using the worst-case infiltration rates (1x10-6 m/s) and the building regulation distance for formal soakaways from buildings, there is not enough space available on the site to accommodate a formal soakaway to discharge the design event and be to be compliant with the BRE 365 drain times (formal soakaways must drain within 24 hrs for the 10-year storm event).

Table 1: Summary of discharge hierarchy

Outfall	Practicable	Proposed	Notes
Into the ground (infiltration)	×	×	Infiltration is not practicable on-site
To a surface water body	×	×	Not possible to reach ordinary watercourse north of site through gravity
To a surface water sewer, highway drain or another drainage system	✓	✓	The surface water runoff will discharge to the treatment tanks on the site
To a combined sewer	×	×	No combined sewers within the vicinity of the site

Proposed Surface Water Drainage System

5.13 Severn Trent have confirmed that the process tanks have capacity to attenuate surface water runoff from the formally drained elements of the site for all events up to the 100 year plus climate change event.

5.14 The proposed strategy is therefore to direct all surface water from the site into the process tanks. Alternative SuDS measures are not required and due to the elevated risk of contamination on site, are likely to be unsuitable.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Detailed flood model information was requested from the EA for the area; however, they have confirmed that there is no detailed modelling available of this section of the River Bure.

6.2 The proposed development is classed as 'Water Compatible'; therefore, the wastewater treatment works would be compatible with any flood zone classification. It is recommended to undertake necessary maintenance to the wastewater treatment works after each flood event.

6.3 The discharge hierarchy has been followed and the strategy is based on discharging to the Dobbs' Beck watercourse via the wastewater treatment works on site.

6.4 The proposed SuDS strategy will reduce the runoff rate to 2 l/s for the 100 year plus 40% climate change rainfall event. To achieve this runoff rate, a total volume of approximately 520 m^3 of storage is required.

6.5 Full drainage details of the surface water strategy will be completed at the detailed design stage. Management and maintenance plans will be developed during the detailed design stage of the development.

6.6 The flood risk assessment concludes that the proposed development is safe from flooding from all sources. Furthermore, there are no receptors that could be vulnerable to increased flood risk within proximity of the site, the impact on third party landowners as a result of the development regarding flooding is therefore considered to be negligible.

APPENDIX A: DRAWINGS

The following drawings are referenced within the body of this report:

- RS-2474-P1-GEO-R0 - Rigour Survey – Topographic Survey
- 955-07-CIV-XX-XX-D-C-30220 – Overall Layout
- 955-07-CIV-XX-XX-D-C-40006 – Access Road Vehicle Tracking
- 955-07-CIV-XX-XX-D-G-20007 – Earthworks Analysis
- STC 0131-TET-XX-XX-DR-M-0001 – Plant Plan

These are included within this Appendix in the order they are referenced.

ANNOTATIONS

DETAIL

AV	Air Valve
BH	Borehole
BO	Bollard
BS	Bus Stop
BU	Bush
BX	Box
CB	Catch Pit/ Box
CO	Column
DC	Drainage Channel
DP	Drain Pipe
DR	Drain
EM	Electric Transformer
EP	Electric Pole
ER	Earth Rod
FH	Fire Hydrant
FH	Flow Hydrant
FP	Flag Pole
FW	Foul Water
GG	Gully Grate
GP	Guard Post
HVAC	Heating Ventilation Air Con
KO	Kerb Outlet
LP	Lamp Post
MK	Marker Post
MPO	Mooring Post
NB	Name Board
NB	Name Board
OHL	Overhead Line
PB	Post Box
PM	Parking Meter
RE	Reed Bed
RE	Rodding Eye
RS	Road Sign
SG	Signal Gantry Post
SC	Stop Cock
SI	Sign
SW	Surface Water
SY	Syphon
SV	Sluice Valve
TC	Telecom Cover
TH	Trial Hole
TP	Tree Pit/ Hole
TP	Telegraph Pole
TSC	Traffic Signal Cover
UM	Unknown Manhole
UT	Unknown Tree
UTL	Unable To Lift
VP	Vent Pipe
WB	Waste Bin
WM	Water Meter
WO	Wash Out

FENCE & WALLS

ABF	Armco Barrier
BW	Brick Wall
BWF	Barbed Wire
CBF	Close Board
CIF	Corrugated Iron
CLF	Chain Link
CPR	Concrete Railing
GAB	Gabion Wall
IRF	Iron Railing
IWF	Interwoven Fence
OBF	Open Board Fence
PAL	Palisade
PCF	Post & Chain
PIF	Post & Iron Rail
PRF	Post & Rail
PWF	Post & Wire
RET	Retaining Wall
SPF	Steel Palisade
STW	Stone Wall
TWF	Timber Fence
VMF	Vero Mesh Fence

LEVELS

AHL	Arch Head Level
ASL	Arch Spring Level
CL	Cill Level
CL	Ceiling Level
DPC	Damp Proof Course Level
EL	Eave Level
DL	Duct Invert Cover Level
EL	Eave Level
FL	Floor Level
FRL	Flat Roof Level
GL	Ground Cover Level
IL	Invert Level
MHL	Manhole Cover Level
RL	Ridge Level
THL	Threshold Level
TOB	Top of Beam Level
TOW	Top of Wall Level
TOF	Top of Fence Level
WCL	Window Cill Level
WCL	Window Cill Level
WHL	Window Head Level
WL	Water Level

TREE SPECIES

HEDGE & SLOPES

Hedge Canopy Symbol

Gate Symbol

Slope Symbol

SURFACE HATCH

Ordnance Survey Data

Building & Structures

Vegetation & Scrub

SURVEY NOTES

The client must check and verify all geospatial data prior to commencing work.

Any errors or discrepancies must be notified to Rigour Survey immediately. The survey control stated is to be used for geomatic land & measured surveys at the stated scale.

Survey control must be checked and verified prior to use.

Dimensions are in metres & the plotting scale indicates the accuracy of the digital data.

Average canopy spreads & trunk diameters have been established for all trees. With descriptions and heights annotated. Please use these as a guide only.

All below ground infrastructure including drainage, utilities & voids have been captured & identified from above ground. Details relating to these features including size, depth & description are approximates only. Services and features may not have been surveyed if obstructed or not reasonably visible at the time of data capture, these have been annotated accordingly.

Supplemented Ordnance Survey data is included for contextual and quality control principles. This data is presented on layer 0-OS-DATA.

Do not scale from this drawing.

GRID & LEVEL

Ordnance Survey national grid coordinates & level have been determined by GNSS RTK survey observations using global navigation satellite systems related to OSTN15(GB) and OSGM15(GB).

The survey grid is orientation is to grid north with a scale factor of 1.000.

SURVEY CONTROL

Control ID	Easting	Northing	Elevation	Description
GCP01	625270.176	314429.846	22.858	Mag Nail
RS03	626583.819	314498.008	10.892	Mag Nail
RS10	626186.845	314549.961	12.048	Peg & Nail
RS11	626366.412	314646.181	10.957	Peg & Nail
RS12	626006.909	314507.812	13.249	Peg & Nail
RS21	625705.104	314386.596	16.516	Mag Nail
RS22	625958.679	314308.110	20.289	Mag Nail

REVISION NOTES

ID Number	Comment	Initials	Date
0	First Issue	DMG	22/12/2023

PROJECT DETAILS

ADDRESS
Beeston Park
Sprowston
Norwich
NR12 7BY

DELIVERABLE TYPE
Geomatics
Topographical Survey

CLIENT
Civic Engineers

ISSUE DATE
22/12/2023

DATA CAPTURE
DMG

DETAILED
DMG

APPROVED
DMG

SCALE
1:500

PROJECT NUMBER
RS-2474

PHASE NUMBER
1

REVISION
0

STATUS
Final

Rigour SURVEY

STANDARD NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECT'S AND ENGINEER'S DRAWINGS AND THE SPECIFICATIONS.
2. THIS DRAWING SHOULD NOT BE SCALED.
3. ALL DIMENSIONS ARE TO BE VERIFIED BY THE CONTRACTOR ON SITE.
4. ALL DISCREPANCIES SHOULD BE REPORTED TO C.A./E.A. PRIOR TO THE COMMENCEMENT OF WORKS.

NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED
2. THIS DRAWING IS BASED ON:
   - TOPOGRAPHICAL SURVEY UNDERTAKEN BY WYG GROUP LTD.; DRAWING NUMBER BG/A071324SUR/01; DATED 01/07/2011
   - MASTERPLAN LAYOUT BY URBED; DRAWING NUMBER 1013-URB-Z0-DR-U-Masterplan_V12; DATED 20.03.2018
   - HIGHWAY BOUNDARIES PROVIDED BY NORFOLK COUNTY COUNCIL; DATED OCTOBER 2012
3. REFER TO PETER BRETT ASSOCIATES DRAWING 24109_008_002 REVISION A FOR INDICATIVE ROUTES OF EXISTING UTILITIES IDENTIFIED IN AREA
4. REFER TO AWORTH DRAWING 5855 REVISION A; DATED 19.09.2019 FOR GPR SURVEY RESULTS

KEY:

- WASTEWATER TREATMENT WORKS RISING MAIN CONTRACT BOUNDARY - PRIMARY ROUTE
- WASTEWATER TREATMENT WORKS RISING MAIN CONTRACT BOUNDARY - SECTION 50 ROUTE
- WASTEWATER TREATMENT WORKS RISING MAIN CONTRACT BOUNDARY - ALTERNATIVE ROUTE SUBJECT TO TOPOGRAPHICAL SURVEY
- PUMPED SECTION OF FOUL WATER RISING MAIN
- GRAVITY-FED SECTION OF FOUL WATER RISING MAIN - PRIMARY ROUTE
- GRAVITY-FED SECTION OF FOUL WATER RISING MAIN - SECTION 50 ROUTE
- GRAVITY-FED SECTION OF FOUL WATER RISING MAIN - ALTERNATIVE ROUTE SUBJECT TO TOPOGRAPHICAL SURVEY

DATE	REV	DESCRIPTION	DRAWN	CHKD
28.11.23	P02	ISSUED FOR INFORMATION	BM	RWi
24.11.23	P01	ISSUED FOR INFORMATION	BM	RWi

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LONDON Reeds Wharf, 33 Mill Street, London SE1 2AX. Tel: 020 7253 2977
LEEDS 1 Saw Mill Street, Water Lane, Leeds, LS11 5WE. Tel: 0113 2025 130
GLASGOW 35 Virginia Street, Glasgow, G1 1TN. Tel: 0141 370 1829
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PROJECT

BEESTON PARK
NORWICH

TITLE

PROPOSED DRAINAGE
WASTEWATER TREATMENT WORKS
RISING MAIN CONTRACT PLAN
OVERALL LAYOUT

DRAWING STATUS	STATUS CODE
INFORMATION	-

CE PROJECT No.	SCALE @ A1	DATE CREATED	DRAWN	CHECKED
955-07	1:4000	NOV 23	BM	RWi

DRAWING No.	REV
955-07-CIV-XX-XX-D-C-30220	P02

FILE LOCATION PATH: P:\PROJECTS HOT\955-07 BEESTON PARK- QUINN ESTATES\004 BIM\CIVILS\DRAWINGS\955-07-CIV-XX-XX-D-C-30220_WWTW CONTRACT PLAN.DWG

STANDARD NOTES

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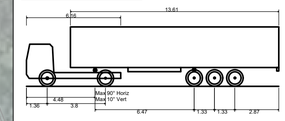
KEY:

- REDLINE BOUNDARY
- VEHICLE BODY TRACKING
- VEHICLE OVERHANG TRACKING
- WHEEL PATH TRACKING

VEHICLE PROFILE:



FTA Design Articulated Vehicle (2016)

Overall Length	16.480m
Overall Width	2.550m
Overall Body Height	3.870m
Min Body Ground Clearance	0.515m
Max Track Width	2.470m
Lock to lock time	3.00s
Kerb to Kerb Turning Radius	6.600m

THE VEHICLE TRACKING SHOWN HAS BEEN GENERATED BY THE USE OF AUTOTRACK (VERSION 2024) AND IS BASED ON THE MOVEMENTS OF A DESIGN VEHICLE AS INDICATED. THE COMPUTER PROGRAM ASSUMES AN 'OPTIMUM VEHICLE' IN TERMS OF PERFORMANCE AND DRIVER ABILITY. ADDITIONAL AREAS FOR UNRESTRICTED MOVEMENT MAY BE REQUIRED, ESPECIALLY FOR SITES WITH SIGNIFICANT GRADIENT. THE TRACKING AREAS SHOWN HAVE BEEN DEVELOPED ON THE ASSUMPTION OF A TWO DIMENSIONAL LAYOUT.

DATE	REV	DESCRIPTION	DRAWN	CHKD
22.02.24	P02	VECHICLE TRACKING UPDATE	RS	RWi
15.12.23	P01	ISSUED FOR INFORMATION	BM	RWi

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GLASGOW 35 Virginia Street, Glasgow, G1 1TN. Tel: 0141 370 1829

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PROJECT

BEESTON PARK
NORWICH

TITLE

WASTE WATER TREATMENT WORKS
ACCESS ROAD VEHICLE TRACKING

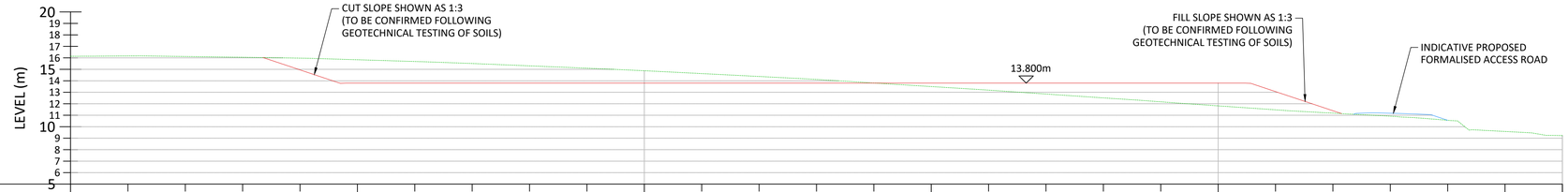
DRAWING STATUS	STATUS CODE
INFORMATION	-

CE PROJECT No.	SCALE @ A1	DATE CREATED	DRAWN	CHECKED
955-07	1:2500	DEC 23	BM	RWi

DRAWING No. 955-07-CIV-XX-XX-D-H-40006 REV P02

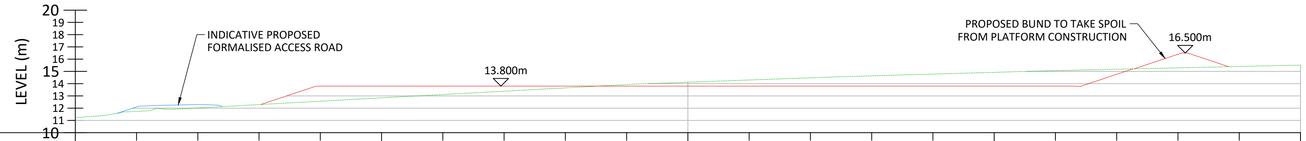
FILE LOCATION PATH: P:\PROJECTS HOT\955-07 BEESTON PARK- QUINN ESTATES\004 BIM\CIVILS\DRAWINGS\955-07-CIV-XX-XX-D-H-40006_WWTW VEHICLE TRACKING.DWG

SITE SECTION A
SCALE: H 1:250,V 1:250. DATUM: 5.000



CHAINAGE (m)	0.000	5.000	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	50.000	55.000	60.000	65.000	70.000	75.000	80.000	85.000	90.000	95.000	100.000	105.000	110.000	115.000	120.000	125.000	130.000
EXISTING LEVELS (m)	16.139	16.164	16.119	16.052	15.975	15.835	15.683	15.508	15.304	15.099	14.878	14.630	14.378	14.118	13.809	13.500	13.186	12.849	12.513	12.170	11.818	11.473	11.182	10.918	10.559	9.587	9.230
PROPOSED LEVELS (m)					14.951	13.800	13.800	13.800	13.800	13.800	13.800	13.800	13.800	13.800	13.800	13.800	13.800	13.800	13.800	13.800	13.800	13.061	11.394				

SITE SECTION 1
SCALE: H 1:250,V 1:250. DATUM: 10.000



CHAINAGE (m)	0.000	5.000	10.000	15.000	20.000	25.000	30.000	35.000	40.000	45.000	50.000	55.000	60.000	65.000	70.000	75.000	80.000	85.000	90.000	95.000	100.000
EXISTING LEVELS (m)	11.225	11.739	12.020	12.294	12.569	12.842	13.113	13.384	13.655	13.925	14.118	14.299	14.478	14.639	14.782	14.925	15.064	15.178	15.291	15.404	15.510
PROPOSED LEVELS (m)					13.796	13.800	13.800	13.800	13.800	13.800	13.800	13.800	13.800	13.800	13.800	13.800	13.800	14.768	16.402		

STANDARD NOTES

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NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED
2. THIS DRAWING IS BASED ON:
   - TOPOGRAPHICAL SURVEY UNDERTAKEN BY RIGOUR SURVEY; DRAWING NUMBER RS-2474-P1-GEO-R0; ISSUED 22/12/2023
   - WASTEWATER TREATMENT WORKS LAYOUT BY SEVERN TRENT; DRAWING NUMBER STC 0131-TET-XX-XX-DR-M-0001 - P03; DATED 01.02.2024

KEY:

- EXISTING GROUND PROFILE
- PROPOSED FINISHED GROUND PROFILE
- INDICATIVE FORMALISED ACCESS ROAD PROFILE

DATE	REV	DESCRIPTION	DRAWN	CHKD
08.02.24	P01	ISSUED FOR INFORMATION	BM	RWi

Civic Engineers

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GLASGOW 35 Virginia Street, Glasgow, G1 1TN. Tel: 0141 370 1829

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PROJECT

BEESTON PARK
NORWICH

TITLE

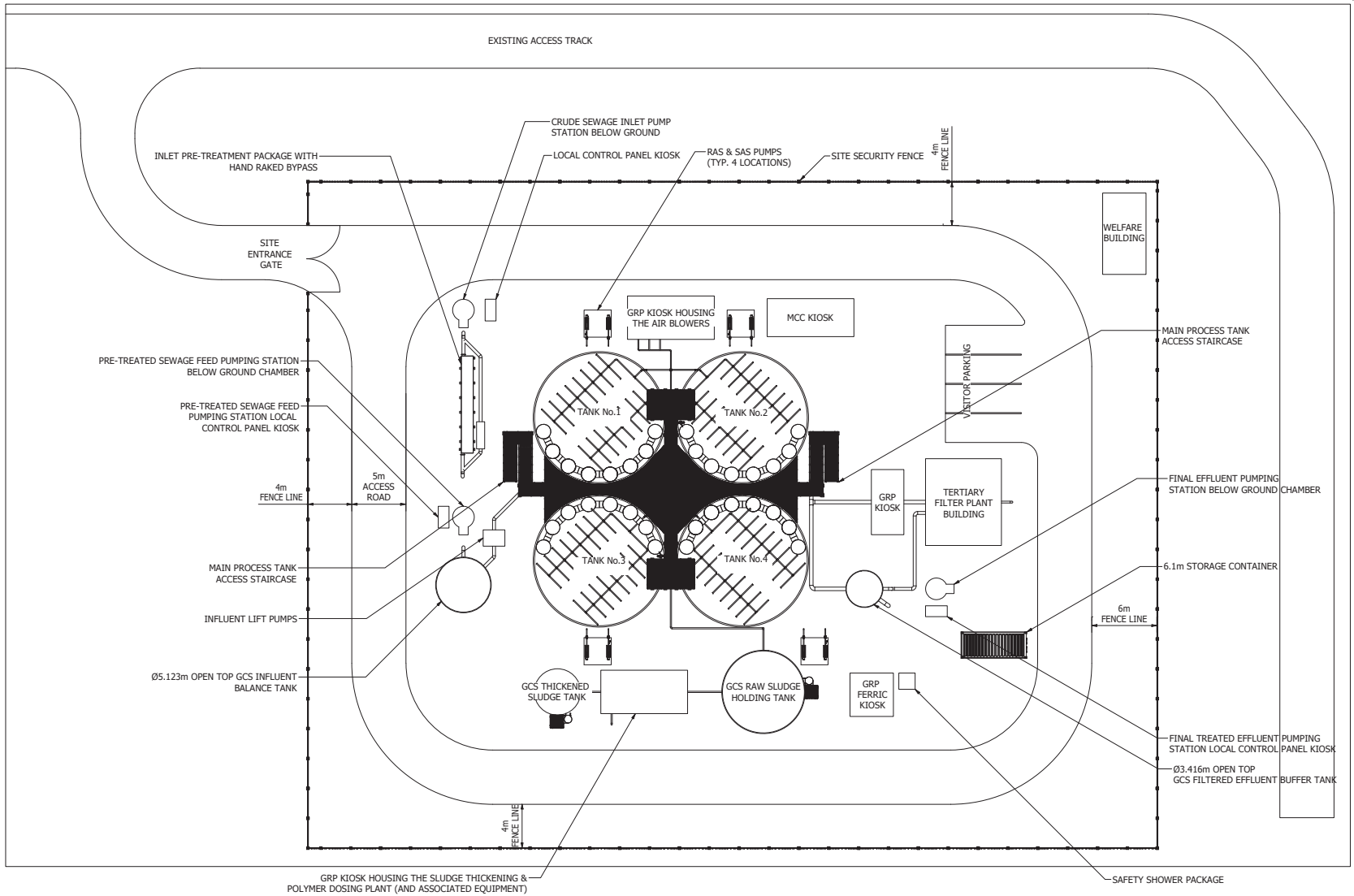
WASTEWATER TREATMENT WORKS
EARTHWORKS ANALYSIS
WASTEWATER TREATMENT FACILITY
SHEET 2

DRAWING STATUS	STATUS CODE
INFORMATION	-

CE PROJECT No.	SCALE @ A1	DATE CREATED	DRAWN	CHECKED
955-07	1:250	FEB 24	BM	RWi

DRAWING No.	REV
955-07-CIV-XX-EW-D-G-20007	P01

FILE LOCATION PATH: P:\PROJECTS HOT\955-07 BEESTON PARK- QUINN ESTATES\004 BIM\CIVILS\DRAWINGS\955-07-CIV-XX-EW-D-G-20007_WWTW CUT & FILL - SHEET 6.DWG



TREATMENT PLANT
1 : 200

NOTES

Scale 1:200

CURRENT REVISION CHANGES
1. PLANT LAYOUT UPDATED.

REV	DATE	DESCRIPTION	DRN	DES	CHK	APP
P03	01.02.2024	FOR INFORMATION ONLY				
P02	30.01.2024	FOR INFORMATION ONLY				
P01	25.10.2023	FOR INFORMATION ONLY				

All dimensions are in millimeters unless otherwise stated. The drawing is submitted for approval on the basis that the Client has obtained all necessary planning permissions, building control, listed building & heritage consents.

WORKING TOLERANCES: (EN 1090-2 2018)

ALL WELDING FABRICATIONS ARE IN ACCORDANCE WITH BS EN 1011-1:2009

THIRD ANGLE PROJECTION

CLIENT

DESIGNER

SEVERN TRENT

ST Connect

PROJECT TITLE
BEESTON TREATMENT PLANT

DRAWING TITLE
PLANT PLAN

DRAWING No.
STC 0131-TET-XX-XX-DR-M-0001

CLIENT DRAWING No.

SHEET SIZE	SHEET	SCALE	REVISION
A1	1 OF 1	1 : 200	P03

APPENDIX B: STATUTORY INFORMATION

The following data for the site and surrounding area have been obtained from public providers:

- Anglian Water Wastewater Asset Location Search

(c) Crown copyright and database rights 2023 Ordnance Survey 100022432 | Date: 30/10/23 | Scale: 1:1250 | Map Centre: 626715,314928 | Data updated: 30/09/23 | Our Ref: 1308618 - 3 | Wastewater Plan A4

- Foul Sewer
- Surface Sewer
- Combined Sewer
- Final Effluent
- Rising Main*
- Private Sewer*
- Decommissioned Sewer*
- Outfall*
- Inlet*
- Manhole*
- Sewage Treatment Works
- Public Pumping Station
- Decomissioned Pumping Station

*(Colour denotes effluent type)

ewan.andrew@waterenvironment.co.uk

22061

final upper side

love every drop anglianwater

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

(c) Crown copyright and database rights 2023 Ordnance Survey 100022432 | Date: 30/10/23 | Scale: 1:1250 | Map Centre: 626623,314742 | Data updated: 30/09/23 | Our Ref: 1308618 - 2 | Wastewater Plan A4

- Foul Sewer
- Surface Sewer
- Combined Sewer
- Final Effluent
- Rising Main*
- Private Sewer*
- Decommissioned Sewer*
- Outfall*
- Inlet*
- Manhole*
- Sewage Treatment Works
- Public Pumping Station
- Decomissioned Pumping Station

*(Colour denotes effluent type)

ewan.andrew@waterenvironment.co.uk

22061

upper side

love every drop anglianwater

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Date: 30/10/23 | Scale: 1:1250 | Map Centre: 626621,314554 | Data updated: 30/09/23 | Our Ref: 1308618 - 1 | Wastewater Plan A4

- Foul Sewer
- Surface Sewer
- Combined Sewer
- Final Effluent
- Rising Main*
- Private Sewer*
- Decommissioned Sewer*
- Outfall*
- Inlet*
- Manhole*
- Sewage Treatment Works
- Public Pumping Station
- Decomissioned Pumping Station

*(Colour denotes effluent type)

ewan.andrew@waterenvironment.co.uk

22061

Beeston, Norwich Wetlands

love every drop anglianwater

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

APPENDIX C: CALCULATIONS

The following calculations have been referenced within the body of this report:

- 22061-SWD-MH-01-P01

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

Half Drain Time : 2472 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	10.207	0.636	0.0	1.4	1.4	179.8	O K
30 min Summer	10.406	0.835	0.0	1.4	1.4	236.0	O K
60 min Summer	10.609	1.038	0.0	1.6	1.6	293.3	O K
120 min Summer	10.795	1.224	0.0	1.7	1.7	345.8	O K
180 min Summer	10.904	1.333	0.0	1.7	1.7	376.6	O K
240 min Summer	10.980	1.409	0.0	1.8	1.8	398.2	O K
360 min Summer	11.083	1.512	0.0	1.8	1.8	427.3	O K
480 min Summer	11.154	1.583	0.0	1.9	1.9	447.3	O K
600 min Summer	11.205	1.634	0.0	1.9	1.9	461.9	O K
720 min Summer	11.245	1.674	0.0	1.9	1.9	473.2	O K
960 min Summer	11.303	1.732	0.0	2.0	2.0	489.5	O K
1440 min Summer	11.351	1.780	0.0	2.0	2.0	503.2	O K
2160 min Summer	11.328	1.757	0.0	2.0	2.0	496.6	O K
2880 min Summer	11.276	1.705	0.0	1.9	1.9	481.9	O K
4320 min Summer	11.150	1.579	0.0	1.9	1.9	446.3	O K
5760 min Summer	11.042	1.471	0.0	1.8	1.8	415.8	O K
7200 min Summer	10.950	1.379	0.0	1.8	1.8	389.7	O K
8640 min Summer	10.871	1.300	0.0	1.7	1.7	367.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	151.352	0.0	106.5	27
30 min Summer	99.623	0.0	109.4	42
60 min Summer	62.272	0.0	228.5	72
120 min Summer	37.155	0.0	239.0	130
180 min Summer	27.282	0.0	250.1	190
240 min Summer	21.866	0.0	258.4	250
360 min Summer	15.976	0.0	269.4	368
480 min Summer	12.793	0.0	276.7	488
600 min Summer	10.776	0.0	281.9	608
720 min Summer	9.374	0.0	285.7	726
960 min Summer	7.541	0.0	290.6	964
1440 min Summer	5.545	0.0	292.7	1442
2160 min Summer	4.040	0.0	544.0	1972
2880 min Summer	3.203	0.0	545.6	2312
4320 min Summer	2.278	0.0	524.2	3076
5760 min Summer	1.785	0.0	822.5	3920
7200 min Summer	1.477	0.0	850.4	4752
8640 min Summer	1.267	0.0	868.3	5544

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	10.801	1.230	0.0	1.7	1.7	347.5	O K
15 min Winter	10.207	0.636	0.0	1.4	1.4	179.8	O K
30 min Winter	10.406	0.835	0.0	1.4	1.4	236.1	O K
60 min Winter	10.609	1.038	0.0	1.6	1.6	293.4	O K
120 min Winter	10.796	1.225	0.0	1.7	1.7	346.1	O K
180 min Winter	10.905	1.334	0.0	1.7	1.7	377.1	O K
240 min Winter	10.982	1.411	0.0	1.8	1.8	398.8	O K
360 min Winter	11.087	1.516	0.0	1.8	1.8	428.4	O K
480 min Winter	11.158	1.587	0.0	1.9	1.9	448.6	O K
600 min Winter	11.212	1.641	0.0	1.9	1.9	463.7	O K
720 min Winter	11.253	1.682	0.0	1.9	1.9	475.3	O K
960 min Winter	11.313	1.742	0.0	2.0	2.0	492.4	O K
1440 min Winter	11.369	1.798	0.0	2.0	2.0	508.0	O K
2160 min Winter	11.354	1.783	0.0	2.0	2.0	504.1	O K
2880 min Winter	11.291	1.720	0.0	1.9	1.9	486.0	O K
4320 min Winter	11.152	1.581	0.0	1.9	1.9	446.9	O K
5760 min Winter	11.020	1.449	0.0	1.8	1.8	409.4	O K
7200 min Winter	10.901	1.330	0.0	1.7	1.7	376.0	O K
8640 min Winter	10.797	1.226	0.0	1.7	1.7	346.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.114	0.0	824.5	6360
15 min Winter	151.352	0.0	106.5	27
30 min Winter	99.623	0.0	109.4	41
60 min Winter	62.272	0.0	228.5	70
120 min Winter	37.155	0.0	238.9	128
180 min Winter	27.282	0.0	250.0	188
240 min Winter	21.866	0.0	258.2	246
360 min Winter	15.976	0.0	269.0	362
480 min Winter	12.793	0.0	276.2	480
600 min Winter	10.776	0.0	281.2	596
720 min Winter	9.374	0.0	284.9	712
960 min Winter	7.541	0.0	289.6	944
1440 min Winter	5.545	0.0	291.0	1398
2160 min Winter	4.040	0.0	542.3	2040
2880 min Winter	3.203	0.0	543.3	2368
4320 min Winter	2.278	0.0	521.7	3248
5760 min Winter	1.785	0.0	822.2	4160
7200 min Winter	1.477	0.0	850.5	5056
8640 min Winter	1.267	0.0	869.5	5968

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Winter	10.702	1.131	0.0	1.6	1.6	319.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Winter	1.114	0.0	827.5	6856

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 626475 314446 TG 26475 14446
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.480

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.160	4	8	0.160	8	12	0.160

Model Details

Storage is Online Cover Level (m) 12.000

Cellular Storage Structure

Invert Level (m) 9.571 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	297.5	0.0	2.428	0.1	0.0
1.828	297.5	0.0	2.429	0.1	0.0
1.829	0.1	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0058-2000-1878-2000
Design Head (m)	1.878
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	58
Invert Level (m)	9.521
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.878	2.0	Kick-Flo®	0.514	1.1
Flush-Flo™	0.254	1.4	Mean Flow over Head Range	-	1.5

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	1.2	1.200	1.6	3.000	2.5	7.000	3.7
0.200	1.4	1.400	1.7	3.500	2.7	7.500	3.8
0.300	1.4	1.600	1.9	4.000	2.8	8.000	3.9
0.400	1.3	1.800	2.0	4.500	3.0	8.500	4.0
0.500	1.2	2.000	2.1	5.000	3.1	9.000	4.1
0.600	1.2	2.200	2.1	5.500	3.3	9.500	4.2
0.800	1.4	2.400	2.2	6.000	3.4		
1.000	1.5	2.600	2.3	6.500	3.5		