YORKSHIRE WATER

FLOOD RISK ASSESSMENT AND OUTLINE DRAINAGE STRATEGY

DEARNE REACH 1 – WETLAND SCHEME

DR1UMP-WSP-XX-RP-D-000002
DECEMBER 2023

PUBLIC

8. OUTLINE SURFACE WATER DRAINAGE STRATEGY

8.1. OVERVIEW

8.1.1. It is essential for any new development that surface water is managed effectively to limit the risk of surface water flooding off-site as well as on site which could be associated with an increase in run-off. As the Proposed Development will only be used to treat final effluent and storm flows through the wetland cells, it is expected to manage the surface water run-off through associated drainage networks and not to increase surface water flood risk.

8.1.2. The National Planning Policy Framework (NPPF) and Planning Policy Guidance (PPG) identify how new developments must take flood risks into account, including additional allowance for climate change impacts, and steer development to those areas at lower risk.

8.1.3. The PPG sets out the requirement to consider Sustainable Drainage Systems (SuDS) within all new development where appropriate. It states that developments should aim to discharge surface water run off 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.

8.2. EXISTING SURFACE WATER DISCHARGE REGIME

8.2.1. The Site has not been previously developed and is deemed to be greenfield land; therefore, the surface water discharge rate of the Proposed Development must not exceed the 5/l/ha greenfield rate run-off rate, as advised by the LLFA see **Appendix E**.

8.2.2. Based on the site topography, the primary method of disposal of surface water run-off is via infiltration, although there are defined overland flow paths which collect and discharge surface water to River Dearne under extreme rainfall events.

8.3. SURFACE WATER MODELLING AND RESULTS

8.3.1. When undertaking the modelling for the surface water drainage strategy the following assumptions were made:

- InfoDrainage software has been used for all hydraulic design;
- FSR rainfall data has been used when determining existing run-off rates;
- HR Wallingford Greenfield Runoff Rate Estimation Tool (www.uksuds.com) was used to determine the proposed greenfield run-off rates;
- CV values are set at 0.750 (Summer) and 0.840 (Winter) within InfoDrainage,
- Infiltration rates have not been assumed as suitable at this stage due to the adjacent wetlands and proximity to the River Dearne, at the detailed design stage this will be reviewed in-line with the site testing results.
- Total development area is 12.033 ha;

- The proposed drainage area of the site access roads is considered to be 0.485 ha.
- The proposed drainage area over the wetland cells is considered to be 6.048 ha.
- The proposed drainage network has been designed for the 1 in 100-year plus 40% climate change allowance.

8.3.2. Modelling results are available in **Appendix F**.

PROPOSED DRAINAGE NETWORK RESULTS

8.3.3. Two separate systems are incorporated in the Proposed Development to deal with the drainage requirements. It is proposed that run-off from the central east-west access road will be captured through an infiltration trench and discharge into the River Dearne with a discharge rate restricted to the existing site greenfield run-off rate (QBar). Surface water run-off from the northern west-east and north-south access roads will flow towards the wetland cells and be accommodated within these features. Further, the wetland cells will provide sufficient storage and treatment for final effluent and storm water from the Wastewater Treatment Works with allowance for the 100-year event plus 40% climate change critical rainfall event over the wetland area. As the flow rate from the wetland cells is restricted to the consented discharge rate to the River Dearne rainfall falling directly on the cells and received from the site access roads is effectively attenuated.

8.3.4. The proposed drainage area for the access roads is 0.485ha incorporating only the carriageway extents within the wetland scheme. Consideration should be given to the effects of rainfall over the wetland cells, which cover 7.642ha and calculations should incorporate the extreme storm events with 40% climate change allowance.

8.3.5. The Site is located in a slowly permeable area as per 2.3 and the infiltration rates should be investigated through the BRE365 testing process. For the purpose of this assessment, it was considered suitable to incorporate SuDS features in-line with the LLFA requirements.

8.3.6. The Site has been split into sub catchments, refer to drawing in **Appendix G**. Each sub catchment is related to the access roads and the wetland cells, which will be incorporated into the design process. The parameters of volumetric run-off coefficient for summer and winter have been used to mimic the carriageway characteristics in a storm event. The surface water run-off from the central east-west road will flow towards the infiltration trench which will capture and convey flows to the combined outfall point before discharging to the River Dearne. This SuDS feature will be installed across the lowest channel line of the central access roads to collect surface run-off. The outfall will regulate the discharge by a 150mm orifice or downstream pipe that would discharge at 24.6 l/s, which is lower than the QBAR value of 41.6 l/s generated from the greenfield site.

8.3.7. Further, the remaining northern west-east and north-south roads will convey any surface water run-off naturally towards the wetland cells for which the Designer has confirmed the sufficient capacity to attenuate the generated volumes from the road catchments. The required volumes have been identified for each road section and resulted to an additional minimum volume of 240m^3 for the northern west-east road that would discharge to the northern wetlands and 90m3 for the north-south road that would discharge to the western wetlands.

8.3.8. The Designer should provide the calculations for the wetland scheme which will take into account the rising main discharge of up to 175 l/s of the existing final effluent flows along with a 200 l/s storm water flow to the wetland. The calculations would provide sufficient allowance for the rainfall events over the access roads and wetland cells, while the discharge to the River Dearn is restricted to 350 l/s.

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- The proposed drainage area over the wetland cells is considered to be 6.048 ha.
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8.3.9. The proposed pumping station will be located within the existing Wastewater Treatment Works and though it will represent an increase in impermeable area, the rainwater will be captured by a gutter pipe system and will convey the water to the pumping station well. This will result in the surface water run-off from the pump station being restricted through the discharge to the wetlands. In a case of failure, the final effluent and storm flows will back up and spill into an overflow immediately upstream of the pump station and connect to an existing outfall into the River Dearne.

8.3.10. At this stage the central east-west access road of the Proposed Development have been modelled as a network using InfoDrainage to determine the required amount of attenuation to accommodate the 1 in 100-year storm event with 40% climate change allowance and to ensure that as a whole the Site will not flood or cause any flooding incidents offsite. The results of this modelling are provided within **Appendix F**, and attenuation requirements are summarised in Table 8-1 below.

Table 8-1 – Central East-West Access Road Proposed Attenuation Requirements

Attenuation Device	Porosity (%)	Total Drainage Area (ha)	Infiltration Rate (m/hr)	Effective Volume Required for 1 in 100 years plus 40% climate change (m^3)	Plan Area Required (m^2)
Infiltration Trench	30	0.169	0	51	180

8.3.11. The proposed surface water discharge should be limited to greenfield run-off rates in accordance with the requirements of the LLFA and are presented in Table 8-2. Should infiltration testing return acceptable infiltration rates, the design should be revised to accommodate these findings.

Table 8-2 - Proposed Surface Water Discharge Rates for Access Roads

Return Period (years)	Proposed Surface Water Discharge Rates (l/s)
Q_{BAR} (l/s)	41.65
1 in 1 year (l/s)	35.82
1 in 30 years (l/s)	72.89
1 in 100 years (l/s)	86.63
1 in 200 years (l/s)	98.71

8.3.12. This positive discharge would require an outfall to the eastern boundary which could be combined with the outfall from the wetlands, this would require a survey of the existing and proposed levels that would identify and to confirm the suitability for a gravity connection. It is currently envisaged that the outfall pipe for the central east-west access road will discharge into the River Dearne in a separate outfall or a bespoke common headwall structure with the wetlands. The outfall would be set above the 1 in 100+ 40% climate change return period river level.

8.3.13. The entire wetland system should be self-contained, with flows entering cell 1 to the north-east of the site through a pumped rising main and discharge over rip rap which will be located through cells 1A and 1B. Cascades, 600mm diameter with stop logs shall accommodate up to 175 l/s between A & B cells. At the outlet of cells 4A & 4B, flows accumulate in discharge pipework, whereby they split into a

discharge chamber prior to cells 5A & 5B, where flows are evenly split (up to 175 l/s) into these cells. Then, flows pass through to cell 7, where they accumulate and discharge via the new outfall with a restricted discharge of 350 l/s to River Dearne.

8.3.14. A written consent from the Environment Agency is required for any proposed works or structures, in, under, over or within 8m of the top of the bank of a main river. The rising main works and outfall structures should be covered under these agreements in-liaison with the EA advice.

8.3.15. Although the above strategy identifies the general principles of surface water drainage management at the Site, assumptions and design solutions proposed will need to be re-assessed at the detailed design stage though the above options demonstrate that there is a viable method to dispose of surface water run-off generated by the site.

8.4. DRAINAGE MAINTENANCE AND MANAGEMENT STRATEGY

8.4.1. The Drainage Maintenance and Management Strategy has been produced by WSP and builds on information provided within the SuDS Manual; it is expected that the maintenance for the entire scheme will be under the management of the Contractor, in which a suitably qualified maintenance specialist will undertake the work.

Table 8-3 – Proposed Drainage Maintenance Strategy

Drainage Feature	Regular Maintenance	Occasional Maintenance	Monitoring
Infiltration Trenches & Soakaway	▪ 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 risks to performance. – Monthly. ▪ Check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary. – Annually. ▪ Remove sediment from pre-treatment structures and /or internal forebays – Annually, or as required.	▪ Repair or rehabilitate inlets, outlet, overflows and vests. – As required.	▪ Inspect/check all inlets, outlet, overflows to ensure that they are in good condition and operating as designed. – Annually ▪ Survey inside of tank for sediment build-up and remove if necessary. – Every 5 years or as required.
Manholes & Inspection Chambers	Inspection chambers will be checked every 6 months for the accumulation of debris and silt and cleaned as necessary.		Inspect every 6 months or after large storm.
Wetlands	▪ Remove litter and debris. – Monthly. ▪ Cut the grass, within public areas. – Monthly. ▪ Cut the meadow grass. – Half yearly. ▪ Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years). – Monthly. ▪ Inspect inlets, outlets, banksides, structures, pipework etc for evidence of blockage and/or physical damage. – Monthly. ▪ Inspect silt accumulation rates in any forebay and in main body and establish appropriate removal frequencies; undertake contamination testing once	▪ Remove sediment from the main body of big ponds when pool volume is reduced by 20%. – With effective pre-treatment, this will only be required rarely, eg every 25-50 years.	▪ Repair erosion or other damage. – As required. ▪ Replant, where necessary. – As required. ▪ Realign rip rap or repair other damage. – As required. ▪ Repair / rehabilitate inlets, outlets, and overflows. – As required.

	some build-up has occurred, to inform management and disposal options. – Half yearly. ▪ Check any mechanical devices eg penstocks. – Half yearly. ▪ Cut submerged and emerged aquatic plants. – Annually. ▪ Remove 25% of bank vegetation from water's edge to a minimum 1mabove water level. – Annually. ▪ Tidy all dead growth (scrub clearance) before start of growing season (Note: tree management is usually part of overall landscape management contract). – Annually. ▪ Remove sediment from any forebay. – Every 1-5 years, or as required. ▪ Remove sediment and planting from one quadrant of the main body of ponds without sediment forebays. – Every 5 year, or as required.		
Pumping Station	As per Manufacturer's advice.	As per Manufacturer's advice.	As per Manufacturer's advice.

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Dimitrios Pantelakis
Site name:	CLAYTON WEST WWTW
Site location:	

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.60478° N
Longitude:	1.59855° W
Reference:	3849751783
Date:	Oct 20 2023 09:27

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 8.334

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	721	721
Hydrological region:	3	3
Growth curve factor 1 year:	0.86	0.86
Growth curve factor 30 years:	1.75	1.75
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

Default Edited

Q_{BAR} (l/s):	41.65	41.65
1 in 1 year (l/s):	35.82	35.82
1 in 30 years (l/s):	72.89	72.89
1 in 100 year (l/s):	86.63	86.63
1 in 200 years (l/s):	98.71	98.71

Project:	Date: 20/10/2023		
	Designed by: UKDXP051	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Storm Phase: Phase	Company Address:		

Infiltration Trench

Type : Infiltration Trench

Dimensions

Exceedance Level (m)	87.200
Depth (m)	0.900
Base Level (m)	86.300
Freeboard (mm)	0
Porosity (%)	30
Length (m)	300.000
Long. Slope (1:X)	200.00
Width (m)	0.600
Total Volume (m³)	50.641

Under Drain

Height Above Base (m)	0.000
Diameter (mm)	150
No. of Barrels	1
Release Height (m)	0.000
Friction Scheme	Manning's n
n	0.015

Inlets

Inlet

Inlet Type	Lateral Inflow
Incoming Item(s)	ROAD C
Bypass Destination	(None)
Capacity Type	No Restriction

Outlets

Outlet

Outgoing Connection	(None)
Outlet Type	Orifice

Diameter (m)	0.150
Coefficient of Discharge	0.600
Invert Level (m)	86.300

Advanced

Conductivity (m/hr)	250.0

Project:	Date: 20/10/2023		
	Designed by: UKDXP051	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address:		

FSR 1: 100 years: Increase Rainfall (%): +40: Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Infiltration Trench	FSR 1: 100 years: +40 %: 30 mins: Winter	88.240	86.650	0.440	0.350	76.1	33.827	0.000	0.000	24.6	50.919	33.202	OK

Project:	Date: 20/10/2023		
	Designed by: UKDXP051	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address:		

FSR 1: 100 years: Increase Rainfall (%): +40: Critical Storm Per Item: Rank By: Max. Avg. Depth

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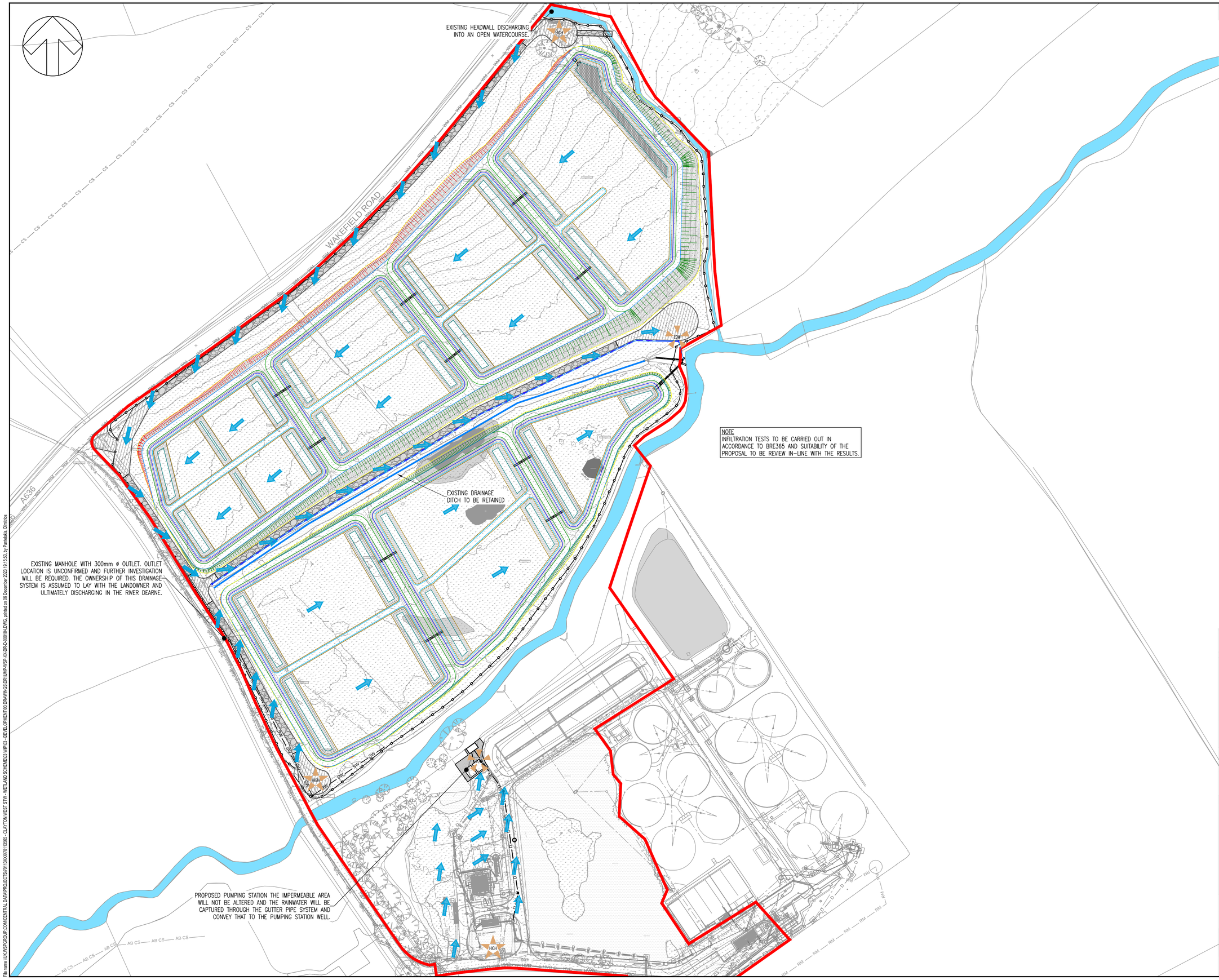
Wetland Cell 4B	FSR 1: 100 years: +40 %: 1440 mins: Winter	89.294	89.294	0.494	0.494	6.9	236.566	0.000	0.000	0.0	0.000	1.444	OK

Project:	Date: 20/10/2023		
	Designed by: UKDXP051	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address:		

FSR 1: 100 years: Increase Rainfall (%): +40: Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Wetland Cell 5B	FSR 1: 100 years: +40 %: 1440 mins: Winter	88.439	88.439	0.439	0.439	2.5	85.751	0.000	0.000	0.0	0.000	14.250	OK



NOTE
INFILTRATION TESTS TO BE CARRIED OUT IN ACCORDANCE TO BRE365 AND SUITABILITY OF THE PROPOSAL TO BE REVIEW IN-LINE WITH THE RESULTS.

DO NOT SCALE

KEY

- SITE BOUNDARY
- OVERLAND FLOOD ROUTE
- SITE LOCAL HIGH POINT / LOW POINT
- EXISTING DITCH

UNTIL TECHNICAL APPROVAL HAS BEEN OBTAINED FROM THE RELEVANT LOCAL AUTHORITIES OR STATUTORY BODIES, IT SHOULD BE UNDERSTOOD THAT ALL DRAWINGS ARE ISSUED AS PRELIMINARY AND NOT FOR CONSTRUCTION. SHOULD THE CONTRACTOR AND / OR EMPLOYER COMMENCE WORK PRIOR TO APPROVAL BEING GIVEN, IT IS ENTIRELY AT THEIR OWN RISK

REV	DATE	BY	DESCRIPTION	CHK	APP
P02	06/12/2023	DP	REVISED TO SUIT LLFA COMMENTS	SG	NS
P01	15/11/2023	DP	FIRST ISSUE	SG	NS

DRAWING STATUS: S2 - FOR INFORMATION

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CLIENT: YORKSHIRE WATER

ARCHITECT:

SITE/PROJECT: AMP7 WINEP DEARNE REACH 1

TITLE: PROPOSED FLOOD EXCEEDANCE ROUTE

SCALE @ A1:	CHECKED:		APPROVED:
1:1000	SG		NS
PROJECT NO: 70113565	DESIGNED: DP	DRAWN: DP	DATE: November 23

DRAWING No: DR1UMP-WSP-XX-DR-D-000104 REV: P02