Tritax Symmetry (Hinckley) Limited

HINCKLEY NATIONAL RAIL FREIGHT INTERCHANGE

The Hinckley National Rail Freight Interchange Development Consent Order

Project reference TR050007

Sustainable Drainage Statement

Report Prepared by: BWB Consulting Ltd

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December 2022

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 Regulation 5(2)(a)

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 Regulation 14

This document forms a part of the Environmental Statement for the Hinckley National Rail Freight Interchange project.

Tritax Symmetry (Hinckley) Limited (TSH) has applied to the Secretary of State for Transport for a Development Consent Order (DCO) for the Hinckley National Rail Freight Interchange (HNRFI).

To help inform the determination of the DCO application, TSH has undertaken an environmental impact assessment (EIA) of its proposals. EIA is a process that aims to improve the environmental design of a development proposal, and to provide the decision maker with sufficient information about the environmental effects of the project to make a decision.

The findings of an EIA are described in a written report known as an Environmental Statement (ES). An ES provides environmental information about the scheme, including a description of the development, its predicted environmental effects and the measures proposed to ameliorate any adverse effects.

Further details about the proposed Hinckley National Rail Freight Interchange are available on the project website:

[redacted]

The DCO application and documents relating to the examination of the proposed development can be viewed on the Planning Inspectorate's National Infrastructure Planning website:

https://infrastructure.planninginspectorate.gov.uk/projects/east-midlands/hinckley-national-rail-freight-interchange/

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EXECUTIVE SUMMARY

This statement and supporting appendices demonstrate that the drainage design for the development will comply with the relevant local and national standards, specifically the hierarchy of discharge, runoff rate and volume criterion.

Proposed discharge rates should be set on a prorated basis of 4.1l/s/ha which equates to the equivalent greenfield QBAR rate, total discharge rates should not exceed that of the calculated total greenfield discharge rate for any given outfall.

Attenuation volumes have been set at 650m3 per drained impermeable hectare, based on preliminary calculations. Final volumes should consider all aspects of the drainage infrastructure and as such final volumes will be determined during detailed design.

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1. INTRODUCTION

1.1. A Sustainable Drainage Statement (SDS) sets out the principles of drainage design for a development and summarises the reasoning behind the chosen design. This includes consideration of national and local guidance, justification of specific flow rates, volumes of attenuated storage, as well as the appropriate level of treatment to be provided to surface water runoff.

1.2. This SDS has been produced by BWB Consulting on behalf of Tritax Symmetry (Hinckley) Ltd in respect of a Development Consent Order (DCO) for a Strategic Rail Freight Interchange (SRFI) on land adjacent to the north-west Junction 2 of the M69 and includes highway works in the wider surrounding area.

1.3. A Flood Risk Assessment has been developed for the site (reference HNRFI-BWB-ZZ-XX-RP-YE-0010_FRA and this Sustainable Drainage Statement accompanies this overarching document.

1.4. This SDS is intended to support an application for a DCO based upon parameter plans and an illustrative layout, as such the level of detail included is commensurate and subject to the level of detail available at this stage. A parameters plan & illustrative layout is included as **Appendix 1**.

1.5. A location plan illustrating the DCO site is illustrated within **Figure 1.1**, with contextual information provided within **Table 1.1**.

Figure 1.1: The DCO Site Location Plan

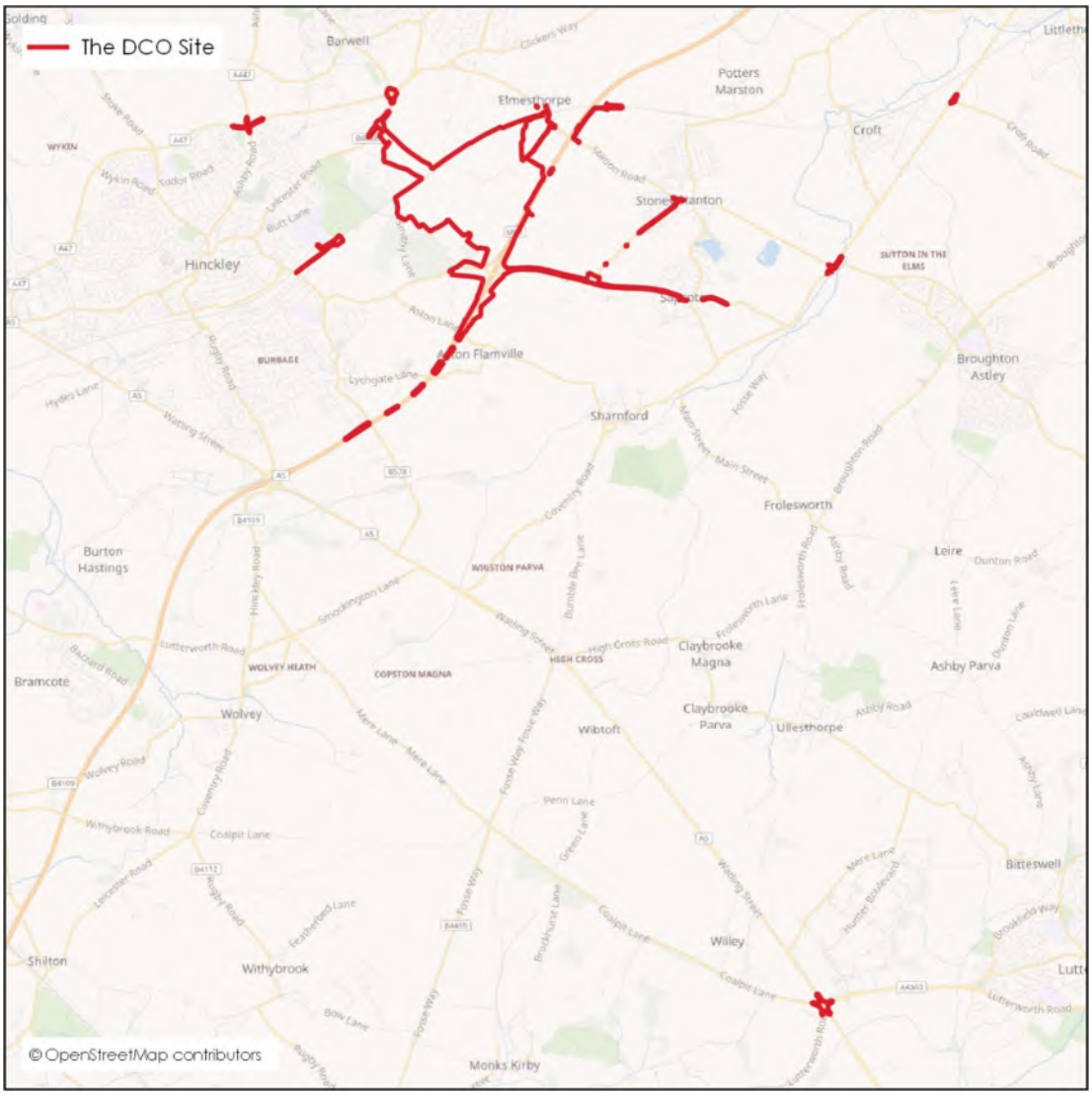


Table 1.1: Site Details

Site Name	Hinckley National Rail Freight Interchange
Location	Leicestershire
Development Type	Primary Road & Rail Infrastructure Rail Port, Warehouses & Ancillary Buildings, and associated infrastructure Landscaping, Ecology & Amenity Areas Highway, Junction and footpath improvements
Lead Local Flood Authority	Leicestershire County Council
Environment Agency Area	East Midlands
Sewerage Undertaker	Severn Trent Water

Proposed Scheme

1.6. The project DCO boundary is shown in **Figure 1.1**, and a parameters plan of the proposals is included as **Appendix 1** for reference.

1.7. The development on the Main HNRFI Site includes:

- The demolition of Woodhouse Farm, Hobbs Hayes, Freeholt Lodge and the existing bridge over the Leicester to Hinckley railway on Burbage Common Road;
- new rail infrastructure including points off the existing Leicester to Hinckley railway providing access to a series of parallel sidings at the HNFRI;
- an intermodal freight terminal or 'Railport';
- warehousing and ancillary buildings;
- an energy centre incorporating an electricity substation;

- a lorry park with welfare facilities and a fuel filling station;
- a site hub building and ancillary car parking;
- terrain remodelling, hard and soft landscape works, amenity water features and planting;
- noise attenuation measures, including acoustic barriers up to six metres in height;
- habitat creation and enhancement;
- pedestrian, equestrian and cycle access routes and infrastructure;
- utility compounds, plant and service infrastructure;
- security and safety provisions inside the HNRFI including fencing and lighting;
- drainage works including surface water retention ponds, underground attenuation tanks and swales;

1.8. Beyond the Main HNRFI Site, the Main Order Limits include:

- works to M69 Junction 2 comprising the reconfiguration of the existing roundabout and its approach and exit lanes, the addition of a southbound slip road for traffic joining the M69 motorway and the addition of a northbound slip road for traffic leaving the M69 motorway at Junction 2;
- a new road ('the A47 Link Road') from the modified M69 Junction 2 to the B4668 / A47 Leicester Road with a new bridge over the railway, providing vehicular access to the proposed HNRFI from the strategic highway network;
- modifications to several junctions and amendments to Traffic Regulation Orders on the local highway network;
- works affecting existing pedestrian level crossings and footpaths.

1.9. The more minor offsite proposals are identified within **Figure 1.2** to **Figure 1.7**. A summary description is provided within **Table 1.2**.

Figure 1.2: Off-Site Highway/Railway Works Location 1

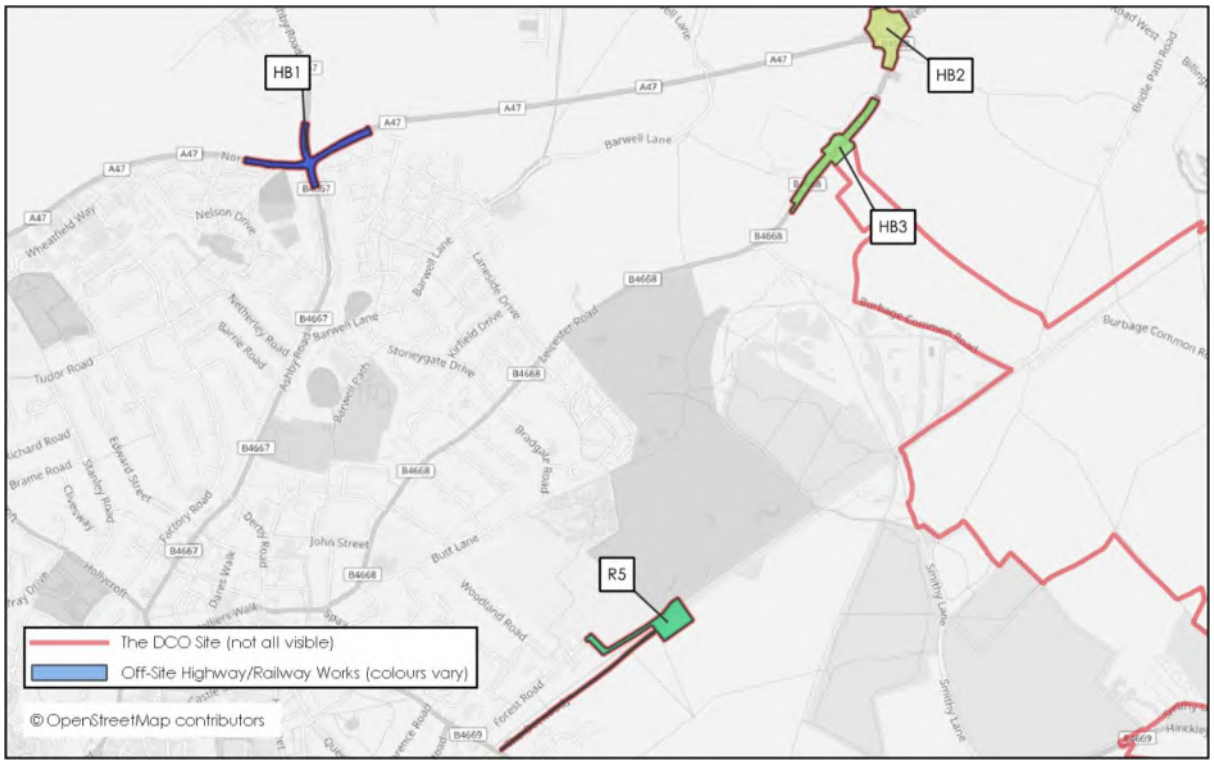


Figure 1.3: Off-Site Highway/Railway Works Location 2

Figure 1.4: Off-Site Highway/Railway Works Location 3

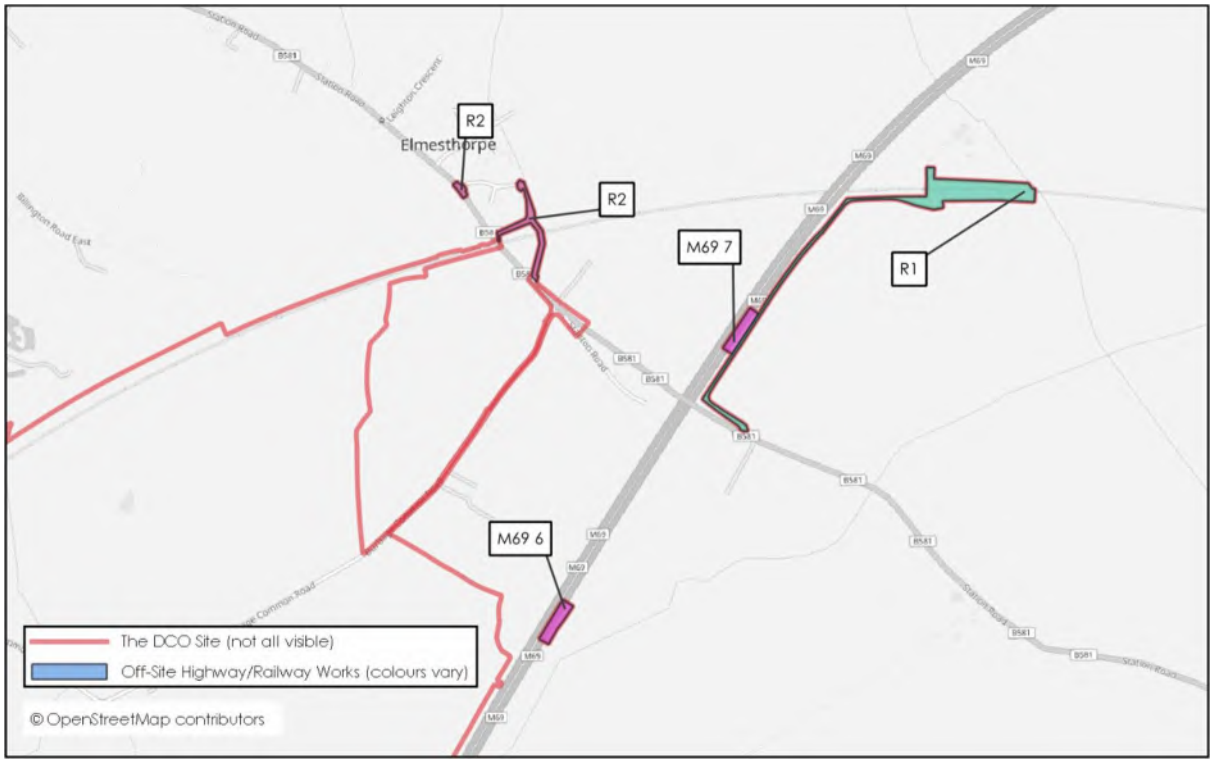


Figure 1.5: Off-Site Highway/Railway Works Location 4

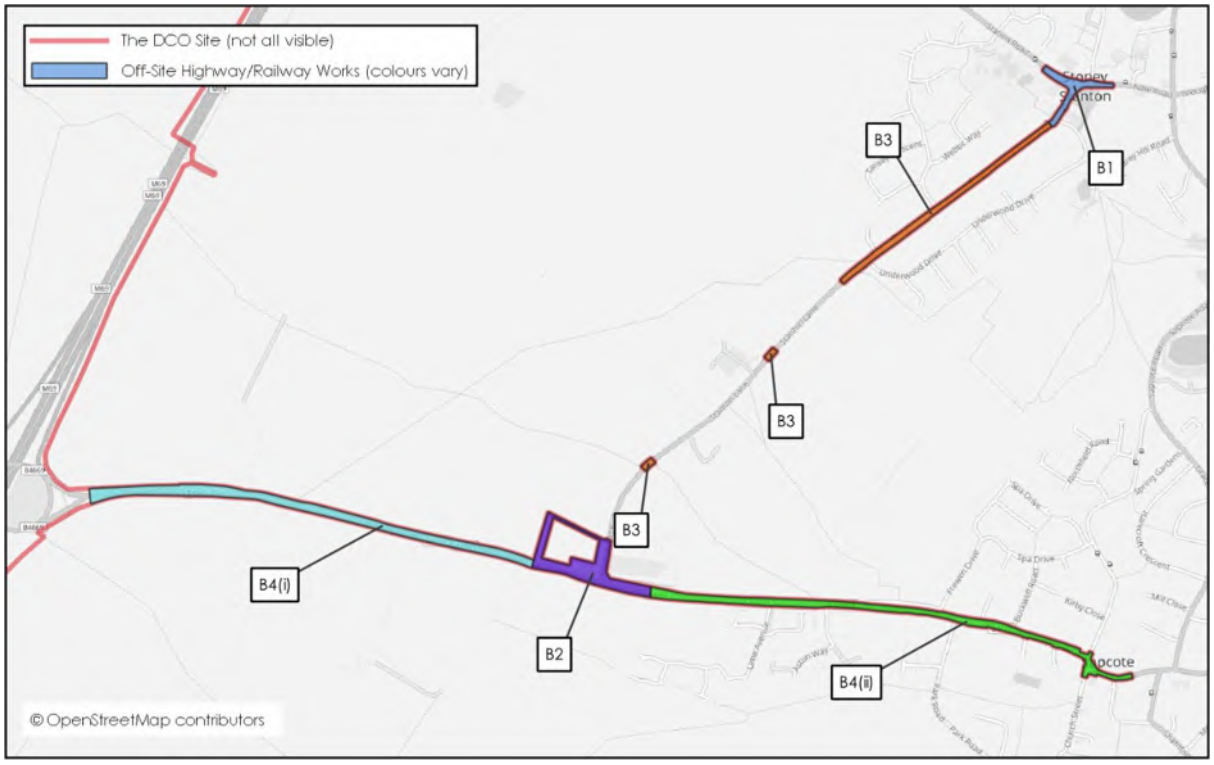


Figure 1.6: Off-Site Highway/Railway Works Location 5

Figure 1.7: Off-Site Highway/Railway Works Location 6

Table 1.2: Summary of Highway & Railway Works away from the Main HNRFI Site, the A47 Link Road, and the M69 Junction 2

ID	Location	Description of Proposed Works
B1	Junction of B581 Station Road / New Road and Hinckley Road, Stoney Stanton	The existing mini roundabout would be replaced by traffic lights with signalised crossings for pedestrians.
B2	Junction of B4669 Hinckley Road and Stanton Lane, west of Sapcote	Traffic lights would be introduced with a phase to allow pedestrians and cyclists to cross.
B3	Stanton Lane / Hinckley Road, south-west of Stoney Stanton	Reduction of the speed limit to 40mph from the national speed limit; traffic calming features and formalisation of on-carriageway parking.
B4 i	B4669 Hinckley Road/ Leicester Road, Sapcote	Traffic calming features, creation of cycle infrastructure and wider footways, public realm and junction improvements and a bus stop relocation at junction of Church Street and B4669. A new pedestrian crossing is included.
B4 ii		
B4 iii		

ID	Location	Description of Proposed Works
B5	Junction of B4114 Coventry Road and B581 Broughton Road at Soar Mill, south-east of Stoney Stanton	New traffic lights are already scheduled to be introduced as part of the Broughton Astley S278 works (Planning Ref: 19/00856/OUT). Should the above committed scheme not come forward in advance of the opening of the HNRFI access infrastructure, the applicant proposes to undertake a mitigation scheme. This would include signalisation of the ghost island junction with the Broughton Road with separate right and left turn lanes and connecting to the existing signalled junction at Coventry Road on the B4114. This layout differs from the S278 proposals by removing the Coventry Road widening, the traffic levels forecast do not require improvements on this arm.
B6	Junction of B4114 Coventry Road and Croft Road, south-west of Narborough	Lane widening on junction approaches
HB1	Junction of A47 Normandy Way and A447 Ashby Road, Hinckley	It is proposed that the approach roads to this junction would all be widened to accommodate additional traffic. Indicative right turn and two lanes would be provided through the junction in a westbound direction.
HB2	Junction of A47 Normandy Way / Leicester Road, the B4668 Leicester Road and The Common, south-east of Barwell	Widening of the entry arm on the B4668 Leicester Road

ID	Location	Description of Proposed Works
HB3	Junction of B4668 and New A47 Link Road, northeast of the site access (Access Infrastructure)	Provision of a three-arm new roundabout access to the B4668 Leicester Road, including a segregated left turn lane southbound from the A47. (*Note: For the purpose of this FRA, due to its close proximity, this has been assessed as part of the A47 Link Road*).
H1	Cross in Hand roundabout at the junction of the A5 Watling Street, A4303 Coventry Road, B4428 Lutterworth Road and Coal Pit Lane, west of Lutterworth	Increased roundabout radius and widened lane entries, with two lanes marked for longer distances for traffic approaching the junction on the A5 Watling Street southbound, the B4027 and on Coal Pit Lane.
R1	B581 to footpath south of Thorney Fields Farm	The proposals in this area include the closure of a level crossing and the existing public right of way diverted with pedestrians rerouted to an existing bridge over the railway south of Thorney Fields Farm.
R2	Footpath between Bostock Close and the B581 Station Road, opposite the Wentworth Arms public house.	The proposals in this area include the permanent closure of a public right of way via a level crossing. Pedestrians would instead be able to cross the railway using the existing Station Road bridge, 75 metres to the south-west. A drop kerb at the junction of Bostock Close and the B581 is also included
R3	Located on the Leicester to Hinckley railway immediately to the north of the Main HNRFI Site	Closure of level crossings. (*Due to their location within/immediately next to the Main Order Limits, and the inconsequential nature of the proposals from a flood risk perspective, a standalone assessment of the flood risk at their locations is not required*).
R4		

ID	Location	Description of Proposed Works
R5	The Outwoods, between Burbage and Hinckley	The proposals in this area include the replacement of the level crossing with a pedestrian footbridge, with associated public rights of way diversions.
M69 1 to M69 7	The M69 on the approach to Junction 2	Changes to signage

Sustainable Drainage Guidance

1.10. Leicestershire County Council as the Lead Local Flood Authority (LLFA) have published a Statutory Consultation Checklist[1] and Guidance[2], on receipt of a formal consultation, the Lead Local Flood Authority (LLFA) will assess the submission in line with the checklist.

1.11. All major applications should include the following information to a level of detail appropriate to the scale of the development;

- Evidence that the site can be drained;
    - In line with the drainage hierarchy for assessing the most appropriate method of discharging surface water.
- Topographic and ground investigation details;
    - Sufficient topographic detail should be submitted to support the drainage proposals. For larger sites, a full topographic survey should be submitted;

[1] Planning Applications: Lead Local Flood Authority Statutory Consultation Checklist (Leicestershire County Council, October 2018)
[2] Interim LLFA Guidance Note: Planning and Development in Leicestershire (Leicestershire County Council, October 2018)

- A desk study should be a minimum approach for a ground investigation review.

- The total impermeable area pre and post development;
    - Provide an indication of pre and post development impermeable areas for comparison.

- All potential flood risk sources have been identified and assessed;
    - The need for modelling should be identified and undertaken where required;
    - The level of detail within a FRA should be appropriate to the scale and nature of the development.

- Existing and proposed peak discharge rates;
    - The existing and proposed discharge rate should be clearly identified and expressed in litres per second (l/s) and litres per second per hectare (l/s/ha);
    - Evidence should be provided to substantiate existing and proposed flow rates;
    - Where discharging to a receiving system maintained and/or operated by another authority (i.e. water company, highway authority, Canals and River Trust, Internal Drainage Board etc.) evidence of consultation and the acceptability in principle of any discharge into their assets should be submitted for consideration by the LLFA and LPA.

- Consideration of sustainable drainage systems;
    - Sustainable drainage systems (SuDS) for managing surface water run-off should be considered for all development;
    - Where SuDS are proposed, these should be detailed to an appropriate level for the type of planning application.

- Attenuation volume calculations;
    - An estimate using industry standard methodology and tools to demonstrate any required attenuation volumes for surface water

storage and confirmation that this can be located within the development masterplan;

- The calculations for attenuation requirements should allow for storm events up to the 1 in 100 year return period plus the appropriate allowance for climate change;
- Where applicable, the impacts of 'urban creep' should be included. Unless it can be demonstrated otherwise, a 10% increase in the impermeable area should be included within the storage calculations.

- Consideration of the maintenance and management of all drainage elements;
  - Details submitted should consider how drainage proposals will be operated and maintained (including access) for the lifetime of the development with particular consideration given to shared elements that are likely to be maintained privately.

1.12. Furthermore, the LLFA will assess all applications in line with the current planning legislation, including;

- National Planning Policy Framework[3] (NPPF),
- Non-Statutory Technical Standards[4],
- Written Ministerial Statement regarding Sustainable Drainage[5] (HCW161),
- The SuDS Manual – C753[6],
- Flood Risk Planning Policy Guidance[7],
- Building Regulations Part H[8].

1.13. To comply with the requirements of the LLFA this Sustainable Drainage Statement has been prepared, in line with the guidance outlined above.

[3] Revised National Planning Policy Framework, Ministry of Housing, Communities & Local Government, amended 2021
[4] 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems
[5] Written Ministerial Statement regarding Sustainable Drainage (The Secretary of State for Communities and Local Government, December 2014)
[6] The SuDS Manual (CIRIA, 2015)
[7] Flood Risk and Coastal Change Guidance (Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government (August, 2021)
[8] Building Regulations Part H: drainage and waste disposal (Ministry of Housing, Communities & Local Government, 2015)

2. EXISTING CONDITIONS

2.1. The Main HNRFI Site lies 3 km to the north-east of Hinckley town centre, to the north-west of Junction 2 of the M69. The Nuneaton to Felixstowe railway forms the north-western boundary, with the M69 motorway defining the south-eastern boundary. To the south-west are blocks of deciduous woodland (including Burbage Wood, Aston Firs and Freeholt Wood), a gypsy and traveller community site and a mobile home site. Beyond the north-eastern boundary lies the village of Elmesthorpe, a linear settlement on the B581 Station Road.

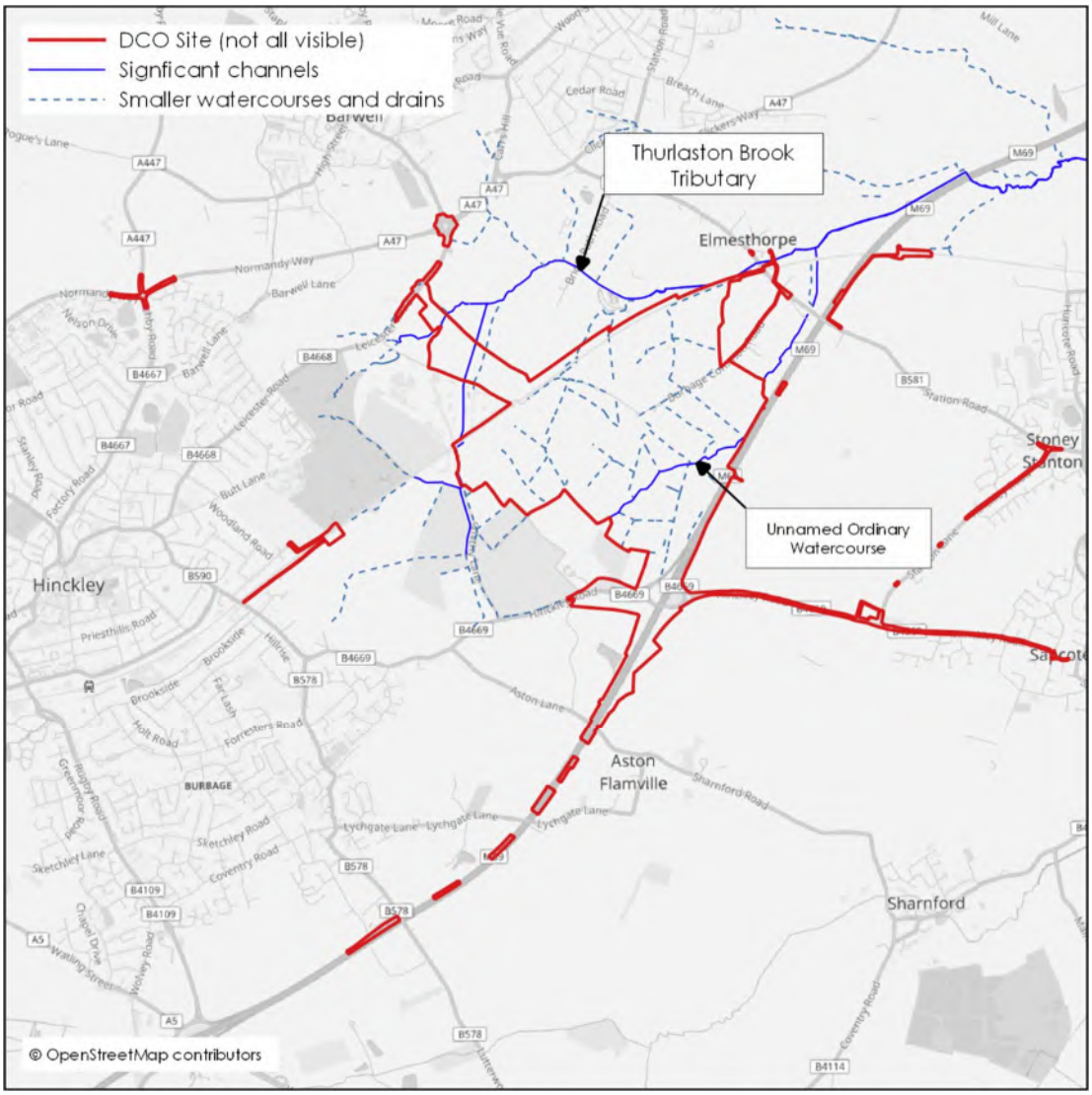
2.2. The Main HNRFI Site comprises the proposed SRFI, which includes but may not be limited to, the railway sidings and freight transfer area alongside the two-track railway between Hinckley and Leicester, land for the development of storage and logistics sheds, site hub building, energy centre, and associated lorry and car parking, infrastructure, and landscaping.

2.3. The Development Consent Order (DCO) Site extends beyond the Main HNRFI Site to include other elements including a new link road from M69 Junction 2 to the B4668 (Leicester Road) ('the A47 Link Road'), and alterations to M69 Junction 2 – this larger area is referred to as the Main Order Limits.

2.4. The DCO Site also extends beyond the Main Order Limits to include other minor highway, junction, and footpath alterations.

2.5. The watercourse network in and around the Main Order Limits, as shown on Ordnance Survey mapping and identified on a site-specific topographical survey (**Appendix 2**), are shown in **Figure 2.1**. The Main Order Limits are located within the catchment of an unnamed tributary of the Thurlaston Brook. This watercourse issues from the eastern side of Hinckley and flows eastwards to the north of the railway line.

Figure 2.1: Watercourse Network



2.6. The Main HNFRI site is predominantly greenfield in nature comprising a series of agricultural fields. Three areas of brownfield development are located within the Main HNRFI Site known as Woodhouse Farm, Hobbs Hayes, Freeholt Lodge.

2.7. For the purposes of this assessment the entire Main HNRFI Site is considered to be greenfield in nature with runoff from the site generally flowing either south to the unnamed ordinary watercourse or north to the Thurlaston Brook Tributary via the network of onsite ditches and culverts beneath the railway. The northern catchment is split between four outfalls, the southern portion is considered to be one catchment, this is summarised within **Table 2.1**. An indicative catchment plan for the existing Site and its various outfalls is shown on BWB Dwg No. HRF-BWB-EWE-ZZ-DR-CD-00501 which is included as **Appendix 3**.

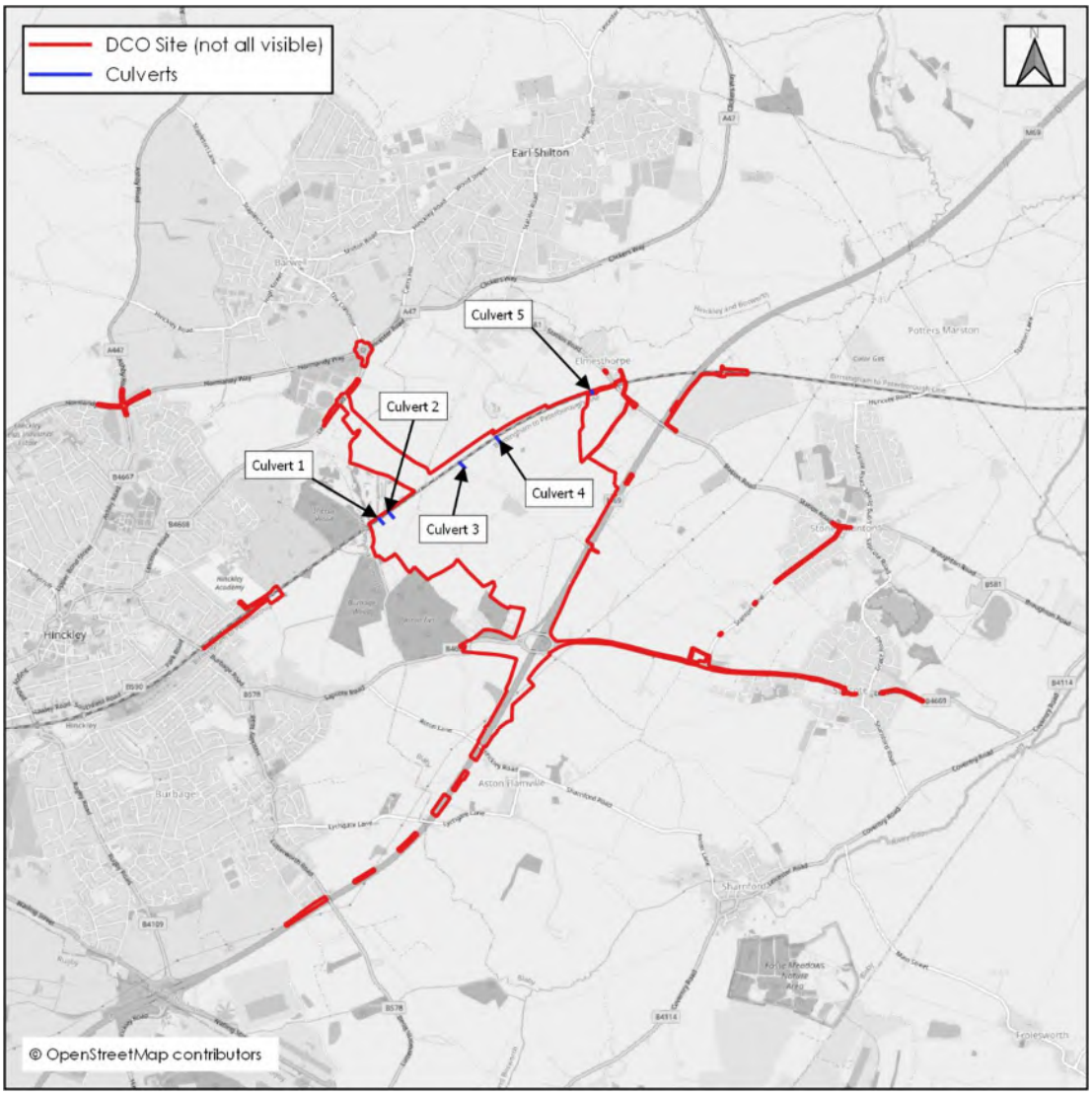
Table 2.1: Existing Outfall Summary

	Catchment	Outfall	QBAR (l/s)
Northern Catchment	1	Culvert 1	64.1
	2	Culvert 3	168.1
	3	Culvert 4	46.1
	4	Culvert 5	136.4
Southern Catchment	5	UOW	369.9

2.8. Severn Trent Water sewer asset records have been obtained and included as **Appendix 4**. The records show a 517mm diameter rising main crossing the north-western corner of the Main HNFRI, the same rising main also crosses mid-way through the DCO boundary for the A47 Link Road. There are public foul sewers shown to serve the residential properties off Burbage Common Road and Stanton Road which discharge north westerly to the Elmesthorpe – Bostock Close Sewage Pumping Station. There is a public combined sewer shown immediately south of the DCO boundary along Smithy Lane which flows south westerly. Beyond this there are various public sewers recorded within the DCO boundary associated with the various offsite highway and footpath works.

2.9. There are known Network Rail drainage assets / culverts along the northern boundary of the Main HNRFI Site. The existing culverts that fall within the DCO limits are shown in **Figure 2.2**.

Figure 2.2: Railway Culvert Locations



2.10. Culverts 1, 3, 4 and 5 will form drainage outfalls from the proposed development, Culvert 2 will remain unaffected. Culverts 1 and 5 will remain in-site and there will be no physical works required to accommodate the site proposals. To accommodate the proposed rail port, Culverts 3 and 4 will need to be extended south (within the site boundary) beyond the proposed rail port.

Existing Runoff Rates

2.11. An assessment of the existing surface water runoff rates from northern and southern catchments of the Main HNFRI Site has been undertaken and is summarised within **Table 2.2**. Calculations are included within **Appendix 5**. The northern catchment is split between four outfalls, the existing split is shown on the

catchment plan included as **Appendix 3**.

2.12. Due to the size of the Site, the runoff rates have been estimated using the IH124 method which applies appropriate reduction factors based on the contributing area, as recommended in Interim Code of Practice for Sustainable Drainage[9]. This was undertaken within Micro Drainage Source Control.

Table 2.2: Existing Runoff Rate from the Site

Return Period (Yrs.)	Northern Catchment (101.2ha) Runoff Rate (l/s)	Southern Catchment (89.8h) Runoff Rate (l/s)	Average Prorated Runoff Rate (l/s/ha)
1	334.2	307.0	3.4
Mean Annual Flow Rate (QBAR)	414.7	369.9	4.1
30	812.5	724.7	8.0
100	1065.7	950.6	10.6

2.13. The average QBAR rate across each of the catchments equates to 4.1l/s/ha and as such will be used across the smaller proposed catchment areas across the DCO limits, as required. This is considered to be a conservative approach as runoff from smaller catchments would actually result in higher runoff rates per hectare.

[9] The National SUDS Working Group (2004), Interim Code of Practice for Sustainable Drainage

Existing Runoff Volume

2.14. An assessment of the existing surface water runoff rates from the Main HNFRI site (191ha) has been made for a 1 in 100-year, 6 hour storm.

2.15. As the existing site is permeable, the runoff volume has been calculated using the Source Control module within Micro Drainage to be **54,342m^3**, results are included within **Appendix 6**.

2.16. Per hectare this equates to a runoff volume of approximately **285 m^3.**

3. SURFACE WATER DRAINAGE STRATEGY

3.1. The proposed drainage strategy sets out the principles that should inform the future detailed design. For the purposes of this assessment the highway corridors and rail port have been taken as 100% impermeable and the development plots have been taken as 90% impermeable. A further allowance will be required from areas of bunds and railway ballast which are assumed to be 20% impermeable, this will need to be considered through detailed design.

Drainage Hierarchy

3.2. The Planning Policy Guidance[10] and the SuDS Manual[11] identify that surface water runoff from a development should be disposed of as high up the following hierarchy as reasonably practicable:

- into the ground (infiltration);
- to a surface water body;
- to a surface water sewer, highway drain, or another drainage system;
- to a combined sewer.

3.3. The aim of this is approach is to manage surface water runoff close to where it falls and mimic natural drainage as closely as possible.

3.4. The existing runoff regime from the Main HNRFI Site is typical of that of a Greenfield site whereby small amounts of rainfall are infiltrated into the ground and the remainder runs off into the network of ditches and watercourse.

3.5. The preliminary ground investigation works undertaken by Hydrock (June 2019) identified Bosworth Clay Member, Thrussington Member and Mercia Mudstone across the site. The previous works concludes that infiltration rates are likely to be low across the site due to the clay soils encountered. This is further supported by the soil value of 0.45 within Micro Drainage, suggesting limited infiltration potential. It may be prudent to perform infiltration testing following the extensive earthworks exercise across the site when formation levels of the various SuDS features are better defined, however, it is thought unlikely that the rates achieved will be suitable and should be treated as providing a nominal drainage function to

[10] Planning Practice Guidance. http://planningguidance.planningportal.gov.uk/.
[11] The SuDS Manual (C753). CIRIA 2015.

ensure a robust design unless proven otherwise.

3.6. To mimic the existing runoff regime, it is proposed to discharge the Main HNFRI Site via various connections to the existing network of ditches and watercourses. To not increase flood risk the site will outfall via ten discharge points with proposed flow rates not exceeding that of the existing scenario, a proposed catchment plan which identifies the proposed locations and discharge rates is shown on BWB Dwg No. HRF-BWB-EWE-ZZ-DR-CD-00503 which is included as **Appendix 7**.

3.7. Separate outfalls will be required for the A47 Link Road and the M69 Junction 2 works, and these are discussed later within this report. The offsite highway and footpath works will utilise the existing infrastructure and major new drainage connections are not anticipated.

Peak Flow Control

3.8. In order to comply with the Non-Statutory Technical Standards for Sustainable Drainage Systems S2-S3[12], runoff from greenfield developments should not exceed the equivalent greenfield rates for the 1 and 100-year return period events.

3.9. To comply with the peak flow control criterion, it is proposed to restrict the discharge rate from the development to the receiving watercourses / culverts at the equivalent greenfield QBAR rate up to and including the 1 in 100-year plus climate change event. This is summarised within **Table 3.1**.

3.10. Due to the size and nature of the development proposals at this stage, the assessment has been set per hectare which can be used on a prorated basis when drained impermeable areas are fixed.

[12] 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems

Table 3.1: Existing & Proposed Runoff Rates

Return Period (Yr.)	Existing Runoff Rate per hectare of greenfield area (l/s/ha)	Proposed Discharge Rate per hectare of impermeable area (l/s/ha)
1	3.4	4.1
QBAR	4.1	
30	8.0	
100	10.6	
100 + CC%	-	

3.11. This approach fulfils the necessary peak runoff control criteria and should be used to base the proposed discharge rates through detailed design. The proposed discharge rate to any one outfall should not exceed that of the existing discharge rates identified on the existing catchment plan, BWB Dwg No. HRF-BWB-EWE-ZZ-DR-CD-00501 which is included as **Appendix 3**.

Attenuated Storage

3.12. As the development proposals require a restricted runoff rate, it will be necessary to provide attenuated storage to balance the excess volume in a safe manner within the site.

3.13. The surface water storage should be located within the site in a position where it can receive runoff from the development and discharge from the site by gravity, and also in a position where it is hydraulically isolated from any fluvial floodplain or external surface water floodplain/ overland flow route that may be present in the site.

3.14. Sufficient storage for events up to the 1 in 100-year storm with an allowance for climate change should be provided.

3.15. For the purpose of this outline assessment, the attenuation has been calculated using 1ha of impermeable area for the 1 in 100-year storm event plus 25% climate change using a singular storage structure. There is a significant amount of upstream infrastructure / source control SuDS that this assessment excludes and therefore it

is anticipated through detailed design that the higher climate change allowances will be accommodated within upstream network, or the freeboard provided within the basins.

3.16. A simulation has been run using Micro Drainage Source Control to identify the necessary storage provision. Using a restriction of 4.1 l/s/ha, the volume of attenuated storage required for the development, per hectare of impermeable area has been calculated for storm events up to the 100 year + 25% storm. The results are summarised in **Table 3.2** and calculations are included as **Appendix 8**.

Table 3.2: Outline Attenuated Storage Requirements

Rainfall Method	Critical Storm	Maximum Volume (m3)
FSR	720 min Winter	581.1
FEH	600 min Winter	646.9

3.17. At this conceptual design stage, a conservative value of 650m^3 of storage per hectare of impermeable development has been used when determining the attenuation requirements across the development. This allows the derivation of runoff rates based purely on the proposed drainage areas and ensures that any areas that were to remain undeveloped would not contribute towards the runoff rates, thus providing a conservative approach in terms of overall discharge rates and attenuation requirements.

3.18. An additional calculation sheet is provided within **Appendix 8** to demonstrate that the 40% climate change allowance event would be contained within the freeboard of a proposed structure. The overall attenuation requirements per hectare of impermeable area increases to approximately 735m^3 during the higher climate change events.

3.19. It is envisaged that the final required attenuated storage volume will be determined during the detailed design stage, once the development layout and drainage areas are fixed.

Runoff Volume Control

3.20. The Non-Statutory Technical Standards for Sustainable Drainage Systems S4-S6[13] states that where reasonably practical the runoff volume from a development for the 1 in 100-year 6-hour rainfall event should not exceed the runoff volume prior to development or redevelopment. Additionally, if practicable on previously developed sites, the runoff volume should not exceed the equivalent greenfield runoff volume. Where it is not reasonably practicable to constrain the volume of runoff from a development at or below the existing volume, then the runoff must be discharged in a manner that does not adversely affect flood risk, i.e.:

- The additional runoff volume resulting from the development (the 'long term storage volume') should be discharged separately from the site at a rate of 2 l/s/ha or less. Or,
- All the runoff volume from the development should be discharged at a rate equivalent to the mean annual flow rate (QBAR) rate under greenfield conditions or less. Or,
- All the runoff volume from the development should be discharged at a rate of 2 l/s/ha or less.

3.21. An estimate of the post-development runoff volume from the 1 in 100-year 6-hour storm can be derived from the Micro Drainage calculations, as provided within **Appendix 8**. The existing and post-development runoff volumes are compared within **Table 3.3**.

Table 3.3: Runoff Volume Comparison

Existing Volume per Hectare (m3)	Proposed Volume Per Hectare (m3)	Difference per Hectare (m3)
285	642	357

3.22. The 1 in 100-year 6-hour storm runoff volume from the site has been shown to increase as a result of the proposed development. However, as the runoff volume from the development will be discharged at a rate equivalent to the mean annual flow rate (QBAR) rate under greenfield conditions, the volume control criteria will

[13] 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems

be met.

Sustainable Drainage Systems

3.23. The proposed drainage strategy can be split into four distinct areas, proposals for each are outlined within the below sections. The respective concept surface water drainage layouts for each are included as **Appendix 9**.

3.24. The principles outlined previously within this report, such as the average greenfield runoff rate of 4.1l/s/ha (**Table 2.2**) and the resulting attenuation requirement of 650m^3/ha (**Table 3.2**) have been used on a pro rata basis to inform the proposed drainage strategy for the Site.

Main HNRFI Site

3.25. A concept surface water drainage layout for the Main HNRFI Site is shown on BWB Dwg No. HRF-BWB-EWE-ZZ-DR-CD-00502.

3.26. There is an existing unnamed watercourse which runs from west to east in the southern portion of the Main HNRFI Site, it is proposed to divert this watercourse to accommodate the proposals for the Site. Two of the existing railway culverts will need to be extended south within the Site. An indicative route for the diversion and extension to the culverts is identified on the concept drainage layout.

3.27. The following SuDS features have been considered appropriate for the development:

- Silt traps
- Sump outfall units/gullies
- Permeable paving (where possible)
- Proprietary vortex separators
- Filter strips
- Geocellular attenuation crates
- Swales
- Detention basins
- Oil Separators

3.28. The proposed drainage strategy aims to mimic the existing conditions across the

site with 10 separate outfalls proposed which will restrict flows at or below the existing discharge rates. Four separate outfalls will discharge north via the existing railway culverts. The remaining six outfalls will discharge south to the diverted watercourse.

3.29. Outfall 1 in the north western corner of the development will discharge at a rate of 10.7l/s which is the calculated greenfield runoff rate from the area of this catchment that is to be redeveloped. Due to the site proposals and anticipated levels the proposed contributing impermeable area to this outfall exceeds the area of the existing catchment, hence there is a requirement to depart from the pro-rata based approach outlined previously. Based on the current measured impermeable area and a discharge rate of 10.7l/s the required attenuation volume has been calculated to be approximately 7,800m^3 for this catchment. A separate source control calculation is included within **Appendix 8**.

3.30. Similar to Outfall 1, it will be necessary to over attenuate the flows discharging via Outfall 3. The existing runoff rate to this area has been calculated to be 46.1l/s and the estimated impermeable area from Unit 08 is 11.9ha, based on these parameters the required attenuation volume has been calculated to be approximately 8,050m^3. A separate source control calculation is included withing **Appendix 8**.

3.31. At present, it is expected that the internal highways drainage will be served by a network of dedicated ponds / swales which have been indicatively sized and shown on the concept drainage layout.

3.32. Plot catchment specific discharge rates and attenuation volumes, at the time of writing, are shown on the proposed drainage plan. It is anticipated that these will be reviewed as the development proposals progress through detailed design. No one outfall from the proposed development should exceed that of the existing rate, based on the existing runoff calculations the overall discharge rate should not exceed 788.3l/s.

3.33. In accordance with Table 26.2 of the CIRCA SuDS Manual, the Main HNRFI Site would present areas of medium and high pollution risk. The use of permeable paving, swales and detention basins will be sufficient to cover the area of medium risk, prior to discharge to the surrounding catchment. Due to the nature of the development, it is expected that the use of oil separators will be required to cover the pollution risk from the higher risk areas of the site.

A47 Link Road

3.34. A concept surface water drainage layout for the Main HNRFI Site is shown on BWB Dwg No. HRF-BWB-EWE-ZZ-DR-CD-00501.

3.35. It has been estimated that the new link road will introduce circa 2.06ha of

impermeable area. The equivalent greenfield runoff rate would equate 8.4l/s for the entire Link Road. In order to avoid impractically low flow rates for some portions of the road, the total discharge rate has been split equally between each of the proposed outfalls. A summary of the existing and proposed flow rates has been included within **Table 3.4**.

Table 3.4: Runoff Rate Comparison (A47 Link Road)

Catchment	Measured Impermeable Area (ha)	Existing Average Runoff Rate (l/s) based on 4.1 l/s/ha	Proposed Discharge Rate (l/s)
Link Road South	0.65	2.6	2.8
Link Road Central	0.58	2.4	2.8
Link Road North	0.83	3.4	2.8
Total	2.06	8.4	8.4

3.36. The subsequent attenuation requirements for each of the proposed detention basins has been calculated using Micro Drainage 'Source Control' based on the above discharge rates, measured impermeable area and the 100 year + 25% storm event. Sensitivity testing shows that the 100 year + 40% event would be contained within the proposed freeboard of each basin. The results are summarised in **Table 3.5** and calculations are included as **Appendix 8**.

Table 3.5: Outline Attenuated Storage Requirements (A47 Link Road)

Catchment	Critical Storm	Maximum volume (m^3)
Link Road South	600 min Winter	415
Link Road Central	600 min Winter	365
Link Road North	720 min Winter	560

3.37. The Proposed Link Road will cross three existing minor watercourses, as such it will be necessary to design and install appropriately sized culverts to not impede or restrict the passage of the existing flows within the channel.

3.38. In accordance with Table 26.2 of the CIRCA SuDS Manual, the proposed link road would represent a Medium pollution risk. In accordance with Table 26.3, the use of detention basins would be sufficient to mitigate the pollution risk of proposed Link Road. If the highways adopting body would require interceptors to be incorporated into the design, then this should be considered through detailed design.

3.39. Due to the low discharge rates, it will be necessary to consider appropriate measure to avoid the passage of silt and debris to avoid potential blockages at the outfall.

M69 Junction 2

3.40. A concept surface water drainage layout for the Main HNRFI Site is shown on BWB Dwg No. HRF-BWB-EWE-ZZ-DR-CD-00505.

3.41. The proposed slip roads will introduce additional impermeable areas that will naturally drain south, back towards the M69. The existing drainage infrastructure serving the M69 is shown to discharge to an unnamed watercourse adjacent to the motorway approximately 700m southwest of the existing Junction 2 roundabout.

3.42. It is expected that water from the proposed slip roads will drain via a series of filter drains. The western slip road is likely to discharge via the existing drainage network and the eastern slip road could potentially connect directly into the watercourse (current outfall) or via the existing drainage network. Flow rates will need to be agreed with Highways England to determine the existing capacity and the requirements for any additional attenuation.

3.43. Given the expected traffic volume, this area of the development is expected to present a high pollution hazard, to support the drainage design and assess the downstream water quality implications, a Highways England Water Risk Assessment Tool (HEWRAT) has been undertaken and is included as **Appendix 10**. In summary, the proposed slip roads are shown to meet the criteria set out within HEWRAT.

Offsite Highway & Footpath Works

3.44. Traffic modelling has identified that upgrade works are required on various parts of the highway network in the vicinity of the development.

3.45. All of the development sites will be within or form part of the adopted highway, managed and maintained by the local highways authority. None of the proposals change the character or use of the existing highways, nor is it likely to have significant impacts in terms of the existing drainage.

3.46. As the new impermeable areas will be comparatively small, it is thought likely that the existing drainage infrastructure will be suitable to serve these areas. This should be considered further through the detailed design of each of these sites.

Residual Risk and Designing for Exceedance

3.47. It is recommended that the final layout uses the proposed road infrastructure, service yards and car parking areas to provide drainage exceedance events. Levels should be designed to provide flow routes to the nearest attenuation structures and outfall locations.

3.48. In addition to the volume of storage provided within the main attenuation, there will be capacity within upstream pipes and manholes which has not been accounted for at this stage and a further level of redundancy to the network will therefore be provided.

4. MAINTENANCE

Main HNRFI Site

4.1. It is envisaged that the majority of the Main HNRFI Sites highways and therefore drainage will remain private and as such should be undertaken by the site operator or a suitably appointed management company.

4.2. Requirements for ongoing maintenance of the drainage network for specific plots should form part of the Operation and Maintenance manual for the site and should be undertaken by the site management. Any specialist or proprietary products that are specified at detailed design should have a manufacturer specific maintenance regime which should be included within the document.

4.3. It is envisaged that the Operation and Maintenance manual will be developed at the detailed design stage and prior to occupation, but some examples for maintenance activities are included below.

- All drainage features should be located in open areas which are readily accessible.
- Gullies should be inspected and de-silted at least once a year, where necessary.
- Pipes, manholes and silt traps should be inspected and de-silted at least once a year, where necessary.
- If permeable paving is incorporated within the layout, it should be swept a minimum of every 6 months to maintain flow capacity of the joints between blocks.
- The surface water attenuation areas will be predominantly dry and the base will be seeded with a wildflower grass seed mix that can tolerate wet ground conditions.
- Regular inspections of the attenuation basin should be undertaken to remove litter/debris, invasive/colonising vegetation and silt build up as necessary. Inlet and outlet structures to be regularly inspected, with remedial work as required to maintain water flows and prevent silt/vegetation build up.
- Vegetation/grass with the attenuation basin should be maintained appropriately to allow establishment and promote habitat formation, without impeding the operation of the inlet and outlet structure.
- The below ground tank should be regularly inspected and jetted, as appropriate, to remove silt and debris.

- Hydro-brakes should be inspected every 6 months, litter/debris and silt build up should be removed as necessary.

A47 Link Road

4.4. It is anticipated that the drainage associated with the link road will be offered for adoption with the Local Highways Authority who will then be responsible for the ongoing maintenance.

M69 Junction 2

4.5. It is anticipated that the drainage associated with the new slip roads will be offered for adoption with National Highways who will then be responsible for the ongoing maintenance.

5. Foul Water Drainage

5.1. The Main HNRFI Site is the only part of the development that will require foul drainage infrastructure. Severn Trent Water have been approached via their Pre-Development Enquiry process, their response is included as **Appendix 11** and identifies the need to upgrade the existing network to accommodate the anticipated foul flows from the development.

5.2. Due to the Sites topography and distance to the nearest public foul water drainage it will be necessary to pump flows from the development, the nearest point of connection is the foul sewer within Burbage Common Road to the northeast.

5.3. As discussed within Section 2 there is an existing Severn Trent Water foul rising main crossing the north-western corner of the site, it will be necessary to divert this main to accommodate the site proposals.

5.4. A concept foul water drainage layout for the Main HNRFI Site is shown on BWB Dwg No. HRF-BWB-EWE-ZZ-DR-CD-00502 which is included as **Appendix 12.** The point of connection, indicative route for the rising main diversion and potential location for the proposed pumping station is identified on the drawing although the exact proposals should be determined through detailed design.

6. SUMMARY

6.1. This statement and supporting appendices demonstrate that the drainage design for the development will comply with the relevant local and national standards, specifically the hierarchy of discharge, runoff rate and volume criterion.

6.2. Proposed discharge rates should be set on a prorated basis of 4.1l/s/ha which equates to the equivalent greenfield QBAR rate, total discharge rates should not exceed that of the calculated total greenfield discharge rate for any given outfall.

6.3. Attenuation volumes have been set at 650m^3 per drained impermeable hectare, based on preliminary calculations. Final volumes should consider all aspects of the drainage infrastructure and as such final volumes will be determined during detailed design.

APPENDICES

Appendix 1: Parameters Plan& Illustrative Layout

Sheet 1 | Sheet 1 | Sheet 3 | Sheet 3 | Sheet 1 | Sheet 3

historic train station

COMMON ROAD

BURBAGE COMMON ROAD

Burbage Common

Burbage Wood

Elmesthorpe Plantation

Freeholt Wood

SMITHY LANE

Hissar House Farm

Bridge Farm

Wood House Farm

Langton House

Langton Farm

Aveley House Farm

Aveley House Cottage

J

E1

E2

D2

D1

B3

B2

B1

C2

C1

H

G

A

F

M69 - J2

Sheet 4 | Sheet 4 | Sheet 5 | Sheet 5 | Sheet 5

N

Key

- Order Limits
- Open land / landscaping, including bunding, attenuation ponds, public footpaths and bridleways, estate road infrastructure, A47 Link Road and any land to be restored to agricultural use.
- Historic woodland protection zone
- Area of existing highways and land reserved adjacent to existing and proposed highways for highways and engineering works including construction and laydown of materials compounds.
- Watercourse
- Existing rail corridor
- Rail freight interchange including A47 Link Road and bridge infrastructure
- Rail corridor within development zones
- New bridge over rail line
- Development zone for site hub
- Line of A47 Link Road and estate roads
- Deviation Potential of A47 Link road and estate roads. The boundaries of zones through which a limit of deviation runs will change depending on the final alignment of the infrastructure within the limit of deviation
- Development Signage Locations
- Rerouting of existing linkage from Bridge Farm to new highway infrastructure
- (x) Development Zones

NOTE 1: Development Zones include the existing buildings to be demolished, the A47 Link Road, estate road infrastructure, rail freight interchange link to estate road and elements pertaining to individual development plots including buildings, hardstandings, parking, energy services, landscaping, bunding and storm water attenuation.
NOTE 2: Noise attenuation measures, ranging from 1.8m to 6m in height are to be provided within the landscaped areas, railport and development zones and are illustratively shown on ESR Figure reference no. 10.10

Schedule of Parameters for Development Zones

Zone	Number of Warehousing Units / Buildings *1	Maximum development floor space per Zone (m²)	Other Defined Element Within Zone	Maximum building / element height measured to roof ridge / highest point in metres above Ordnance Datum		Equivalent building height relative to FFL
A	1 to 6 warehousing units	105,000 sq.m.		119.15m		Up to 22m
B	1 to 5 warehousing units	115,000 sq.m.		B1 115.65m		Up to 22m
				B2 121.65m		Up to 28m
				B3 115.65m		Up to 22m
C	1 to 6 warehousing units	140,000 sq.m.		C1 119.15m		Up to 22m
				C2 122.15m		Up to 25m
D	1 to 4 warehousing units	184,000 sq.m.		D1 119.15m		Up to 22m
				D2 125.15m		Up to 28m
E	1 to 3 warehousing units	137,000 sq.m.		E1 118.65m		Up to 25m
				E2 115.65m		Up to 22m
F	1 to 2 buildings	500 sq.m.		111.50m		Up to 10m
G	1 to 2 buildings	500 sq.m.		107.15m		Up to 10m
			Energy Services	112.15m		
H	1 to 2 buildings	750 sq.m.		107.15m		Up to 10m
			Yard (including container stacks)	119.15m		Up to 20.7m
J	1 to 2 buildings	500 sq.m.		106.50m		Up to 10m
			Yard (including container stacks)	112.50m		Up to 14.5m
			Gantry Cranes	123.50m		
Total maximum floor space across the development*2		650,000 sq.m.				

*1 These are the potential number of main use buildings in each zone and excludes any ancillary buildings or structures.
*2 This total floor space is the maximum floor space (excluding mezzanine space) that will be developed across the site notwithstanding that the maximum floor space stated for each Zone combined would exceed this figure i.e. it is the overall floor space cap for each zone excluding mezzanine floor space.

no. date revision by

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client

TRITAX SYMMETRY
A TRITAX BIG BOX COMPANY

project

HINCKLEY NATIONAL RAIL FREIGHT INTERCHANGE

drawing

Parameters Plan - Sheet 2

scale 1:2500 @ A0 drawn mjl

checked mjl date November 2022

Regulation no.5(2)(o)

Plan No: 2.12 B
Status - Final

0m 10 20 50 100m 150 200m
Scale Bar

Schedule of Accommodation						
All areas are gross internal						
Unit	Distribution	Offices	Total	Car Parking	Lorry Parking	Height
01	61,435 sq.m.	2,787 sq.m.	64,222 sq.m.	534 no. spaces	114 no. spaces	Up to 22m
02	25,316 sq.m.	1,208 sq.m.	26,524 sq.m.	221 no. spaces	45 no. spaces	Up to 22m
03	25,548 sq.m.	1,115 sq.m.	26,663 sq.m.	222 no. spaces	53 no. spaces	Up to 22m
04	44,825 sq.m.	2,090 sq.m.	46,915 sq.m.	391 no. spaces	63 no. spaces	Up to 22m
05	32,702 sq.m.	1,672 sq.m.	34,374 sq.m.	286 no. spaces	51 no. spaces	Up to 28m
06	130,992 sq.m.	4,645 sq.m.	135,637 sq.m.	1130 no. spaces	191 no. spaces	Up to 25m *1
07	95,225 sq.m.	2,369 sq.m.	97,594 sq.m.	813 no. spaces	76 no. spaces	Up to 22m
08	76,551 sq.m.	2,369 sq.m.	78,920 sq.m.	658 no spaces	63 no. spaces	Up to 28m
09	128,948 sq.m.	3,252 sq.m.	132,200 sq.m.	1102 no. spaces	180 no. spaces	Up to 25m *1
		Total	643,049 sq.m.	5,357 no. spaces	836 no. spaces	
		Railport	465 sq.m.	99 no. spaces		
		Lorry Park & Drivers Welfare	465 sq.m.	11 no. spaces	104 no. spaces	
		Amenity & security Offices	465 sq.m.	18 no. spaces		
		Total Development	644,444 sq.m.	5,485 no. spaces	940 no. spaces	

*1 The height noted, is based upon the maximum level of any building or structure Above Ordnance Datum (A.O.D) as defined on the Parameters Plan, Plan 2.12, for part of the overall plot, with the balance being restricted to the lower A.O.D. also defined on the Parameters Plan.

Key

- New M69 Slip Lanes
- A47 Link Road
- A47 Link Bridge Crossing
- Estate Roads
- Railport - Sidings
- Railport - Container Storage
- Lorry Park, Energy Services & Drivers Welfare
- Site Hub
- Building Footprints (Unit 03)
- External Yards
- Parking Areas
- Water Features and Ponds
- New Bridleway within main HNRFI site
- New landscaping within main HNRFI site
- Well Being Zone
- Existing surrounding landscaping and farmland
- Existing woodland
- Existing alignment of public footpaths and bridleways (orange)
- Proposed alignment of public footpaths and bridleways (blue)
- Proposed alignment of pedestrian footpath / cycleway link (purple)

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client

TRITAX SYMMETRY
A TRITAX BIG BOX COMPANY

project

HINCKLEY NATIONAL RAIL FREIGHT INTERCHANGE

drawing

Illustrative Context Masterplan

scale 1:4000 @ A0 drawn mjl

checked mjl date July 2022

Regulation no.5(2)(o)

Plan No: 2.9

Status - Final

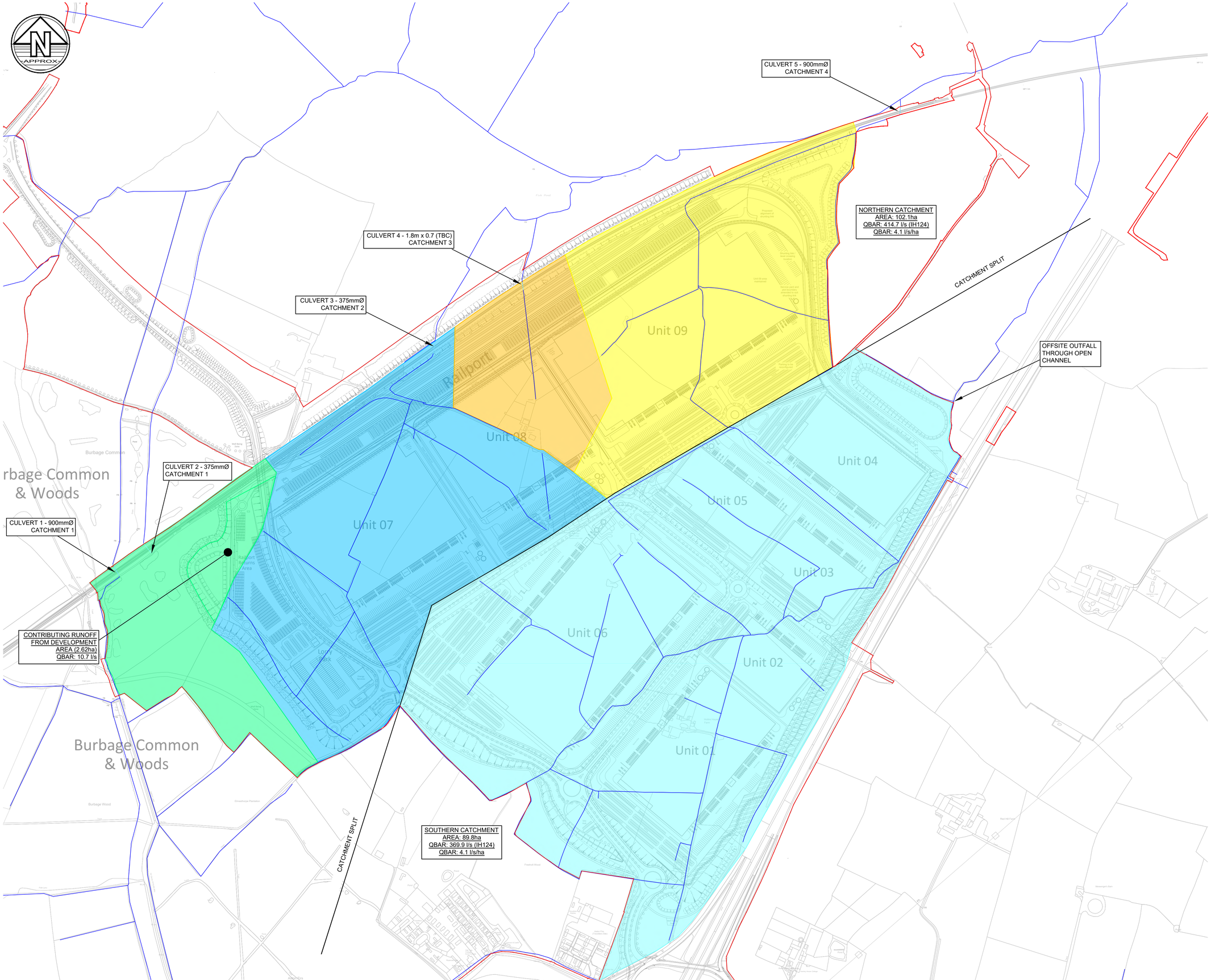
Scale Bar 0 50m 100m 150m 200m

APPENDICES

Appendix 2: Topographical Survey

APPENDICES

Appendix 3: Existing Catchment Plan



Notes

1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.
5. Greenfield runoff calculations based on the IH124 methodology. Rates outlined within the summary table outline the QBAR rate for the corresponding catchment.

Legend

APPLICATION BOUNDARY

APPROXIMATE LINE OF EXISTING DITCHES / WATERCOURSES

CATCHMENT SUMMARY			
REFERNCE		CONTRIBUTING AREA (ha)	DISCHARGE RATE (l/s)
1		15.8	64.1
2		41.4	168.1
3		11.3	46.1
4		33.6	136.4
5		89.8	369.9

Rev	Date	Details of issue / revision	Drw	Rev
P04	05.09.22	Updated to latest site layout	RJ	CD
P03	14.12.21	Updated DCO boundary	RJ	CD
P02	01.10.21	Updated to latest masterplan	RJ	CD
P01	25.05.21	Preliminary Issue	RJ	CD

Issues & Revisions

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Client

TRITAX SYMMETRY

Project Title

HINCKLEY RAIL FREIGHT INTERCHANGE

Drawing Title

EXISTING CATCHMENT PLAN

Drawn:	RJ		Reviewed:	CD	
BWB Ref:	NTT 2814	Date:	25.05.21	Scale@A1:	1:4000

Drawing Status

PRELIMINARY

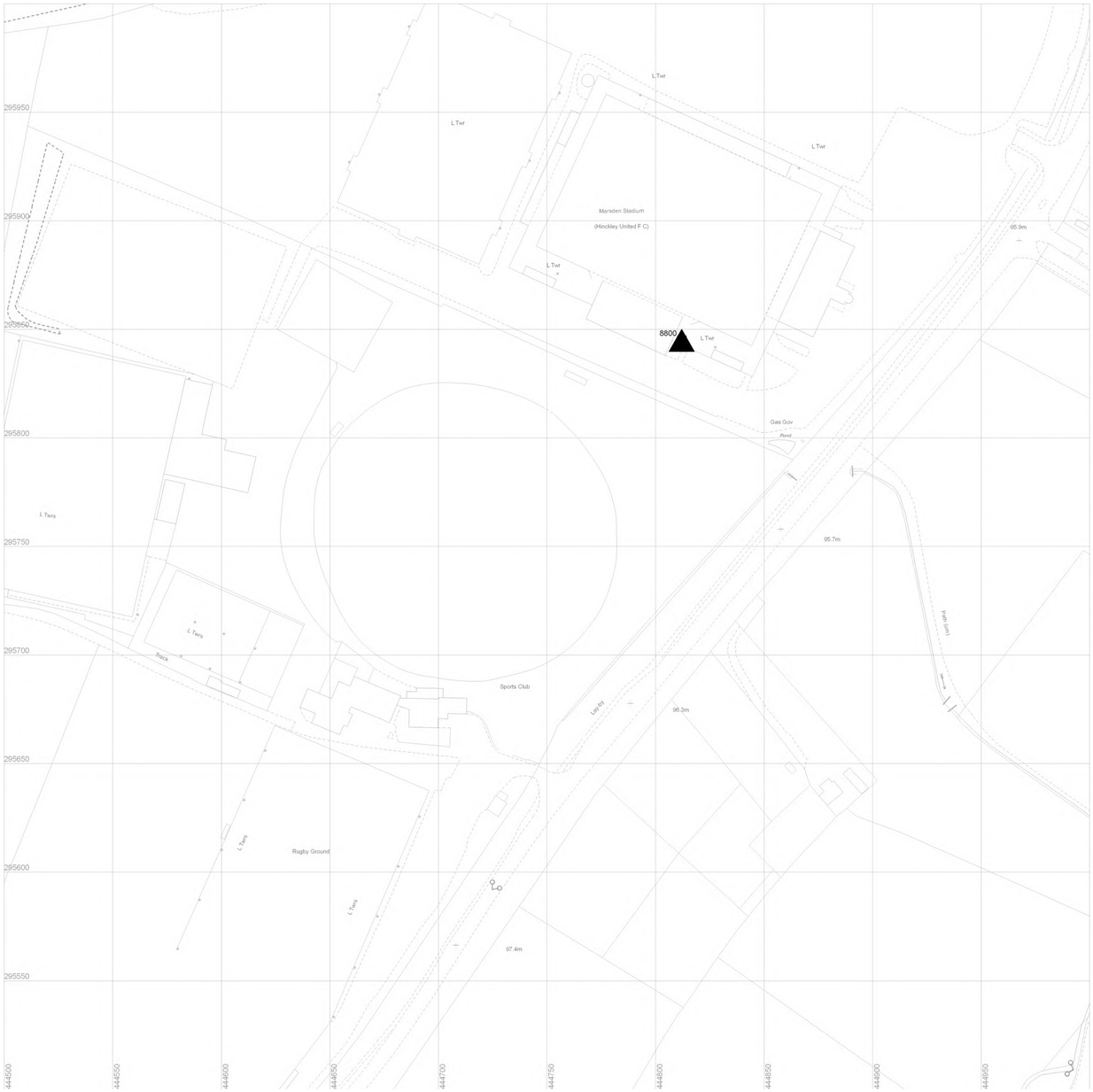
Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
HRF-BWB-EWE-ZZ-DR-CD-00501	S2	P04

X:\NTT\NTT2814_Hinckley Rail Freight Interchange\02. Project Delivery\01. WIP\Drawings\Water\HRF-BWB-EWE-ZZ-DR-CD-00501_Existing Catchment Plan P04.01.dwg

APPENDICES

Appendix 4: Severn Trent Water Asset Records

SP4496SE



SP4495SE

SP4395NW

SP4496NW

- Abandoned Sewer
- Private Combined Gravity Sewer
- Private Foul Gravity Sewer
- Private Surface Water Gravity Sewer
- Public Combined Gravity Sewer
- Public Foul Gravity Sewer
- Public Surface Water Gravity Sewer
- Trunk Combined Gravity Sewer
- Trunk Foul Use Gravity Sewer
- Trunk Surface Water Gravity Sewer
- Combined Use Pressurised Sewer
- Foul Use Pressurised Sewer
- Surface Water Pressurised Sewer
- Highway Drain
- Combined Lateral Drain (SS)
- Foul Lateral Drain (SS)
- Surface Water Lateral Drain (SS)

- Cable, Earthing
- Cable Junction
- Cable, Optical Fibre/Instrumentation
- Cable, Low Voltage
- Cable, High Voltage
- Cable, Other
- Housing, Building
- Housing, Kiosk
- Disposal Site
- Sewage Treatment Works
- Housing, Other
- Pipe Support Structure
- Sewage Pumping Facility
- Sewer Facility Connection Inlet / Outlet

- Blind Shaft
- Combined Use Manhole
- Flushing Chamber
- Foul Use Manhole
- Grease Trap
- Head Node
- Hydrobrake
- Lamphole
- Outfall
- Overflow
- Penstock
- Petrol Interceptor
- Sewer Blockage
- Sewer Collapse

- Sewer Chemical Injection Point
- Sewer Junction
- Sewerage Air Valve
- Sewerage Hatch Box Point
- Sewerage Isolation Valve
- Soakaway
- Surface Water Manhole
- Vent Column
- Waste Water Storage
- Culverted Watercourse
- Pre-1937 Properties

MATERIALS

AC	- ASBESTOS CEMENT
BR	- BRICK
CC	- CONCRETE BOX CULVERT
CI	- CAST IRON
CO	- CONCRETE
CSB	- CONCRETE SEGMENTS (BOLTED)
CSU	- CONCRETE SEGMENTS (UNBOLTED)
DI	- DUCTILE IRON
GRC	- GLASS REINFORCED CONCRETE
MAC	- MASONRY IN REGULAR COURSES
MAR	- MASONRY RANDOMLY COURSED
PE	- POLYETHLENE
PF	- PITCH
PP	- POLYPROPYLENE
PSC	- PLASTIC STEEL COMPOSITE
PVC	- POLYVINYL CHLORIDE
RPM	- REINFORCED PLASTIC MATRIX
SI	- SPUN (GREY) IRON
XXX	- OTHER

CATEGORIES

W	- WEIR
C	- CASCADE
DB	- DAMBOARD
SE	- SIDE ENTRY
FV	- FLAP VALVE
BD	- BACK DROP
S	- SIPHON
HD	- HIGHWAY DRAIN
S104	- SECTION 104

SHAPE

C	- CIRCULAR
E	- EGG SHAPED
O	- OTHER
R	- RECTANGLE
S	- SQUARE
T	- TRAPEZOIDAL
U	- UNKNOWN

PURPOSE

C	- COMBINED
E	- FINAL EFFLUENT
F	- FOUL
L	- SLUDGE
S	- SURFACE WATER

TABULAR KEY

A. Sewer pipe data refers to downstream sewer pipe.

B. Where the node bifurcates (splits) X and Y indicates downstream sewer pipe.

C. Gradient is stated a 1 in...

All Private Sewers are shown in magenta
All section 104 sewers are shown in green
All Sewers that have been transferred to Severn Trent Water after the 1st October 2011, but have not been surveyed and confirmed by Severn Trent Water are shown in orange

N
W E
S

SEVERN TRENT WATER

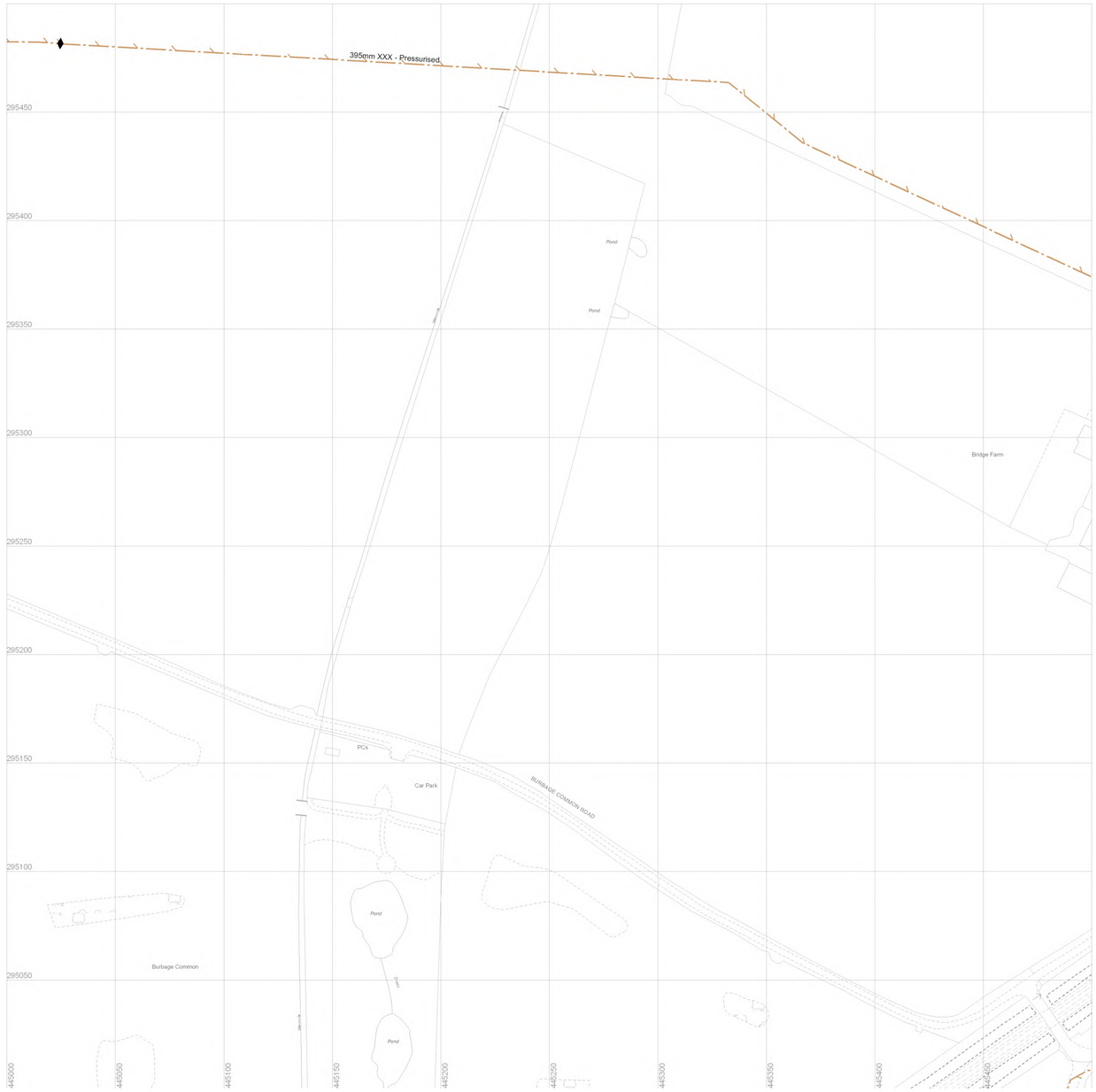
Severn Trent Water Limited
Asset Data Management
PO Box 5344
Coventry
CV3 9FT
Telephone: 0845 601 6616

SEWER RECORD (TABULAR)

O/S Map scale: 1:250
Date of issue: 04.06.19
Sheet No. 1 of 1

This map is centred upon:
O / S Tile reference:
SP4495NE

SP4595NW



SP4495SE

SP4595SE

SP4594NW

- Abandoned Sewer
- Private Combined Gravity Sewer
- Private Foul Gravity Sewer
- Private Surface Water Gravity Sewer
- Public Combined Gravity Sewer
- Public Foul Gravity Sewer
- Public Surface Water Gravity Sewer
- Trunk Combined Gravity Sewer
- Trunk Foul Use Gravity Sewer
- Trunk Surface Water Gravity Sewer
- Combined Use Pressurised Sewer
- Foul Use Pressurised Sewer
- Surface Water Pressurised Sewer
- Highway Drain
- Combined Lateral Drain (SS)
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- Cable, Earthing
- Cable Junction
- Cable, Optical Fibre/Instrumentation
- Cable, Low Voltage
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S104	- SECTION 104

SHAPE

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R	- RECTANGLE
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N
W E
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CV3 9FT
Telephone: 0845 601 6616

SEWER RECORD (TABULAR)

O/S Map scale: 1:250
Date of issue: 04.06.19
Sheet No. 1 of 1

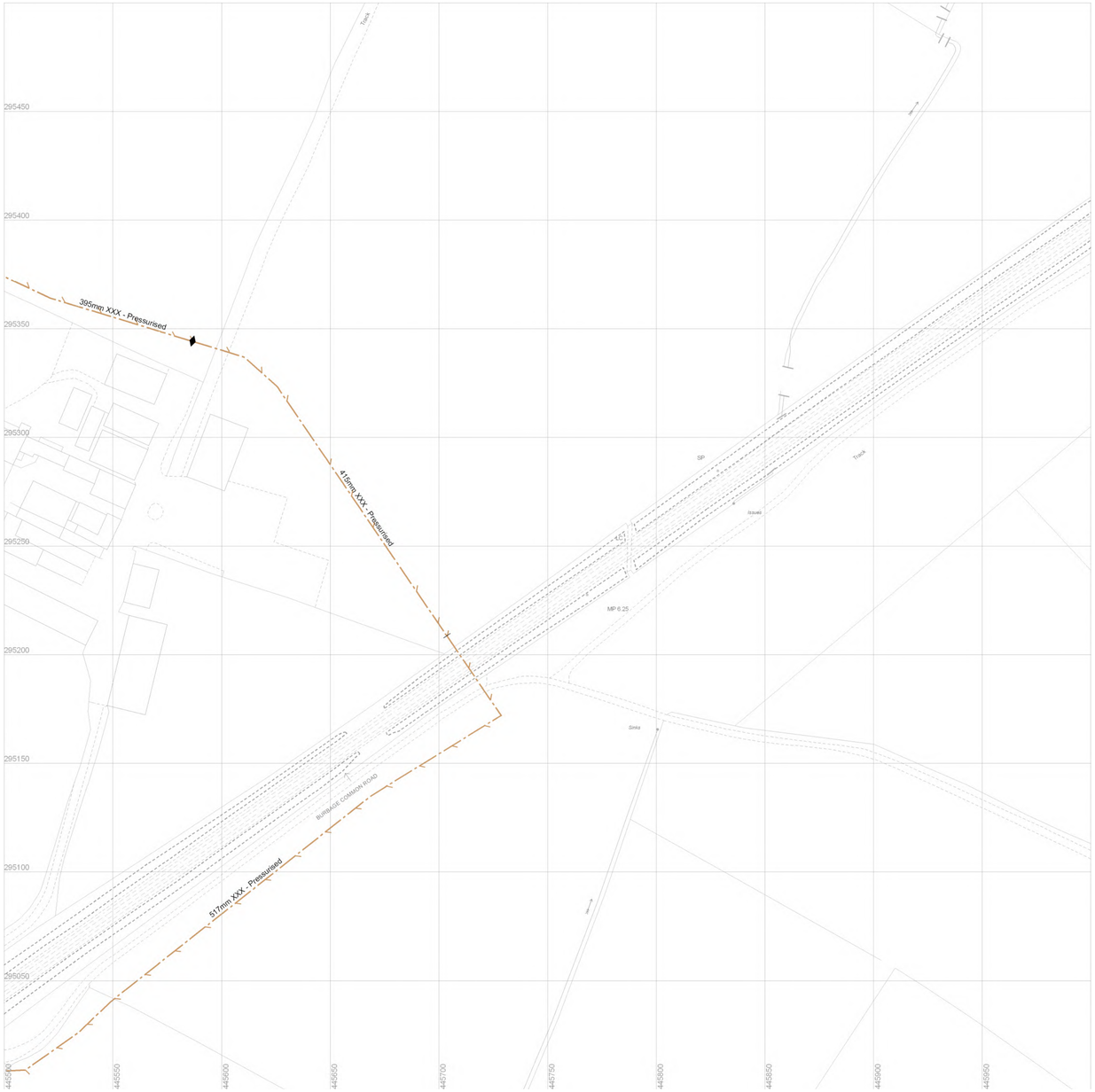
This map is centred upon:
O / S Tile reference:

SP4595SW

SP4595NE

SP4595SW

SP4695SW



SP4594NE

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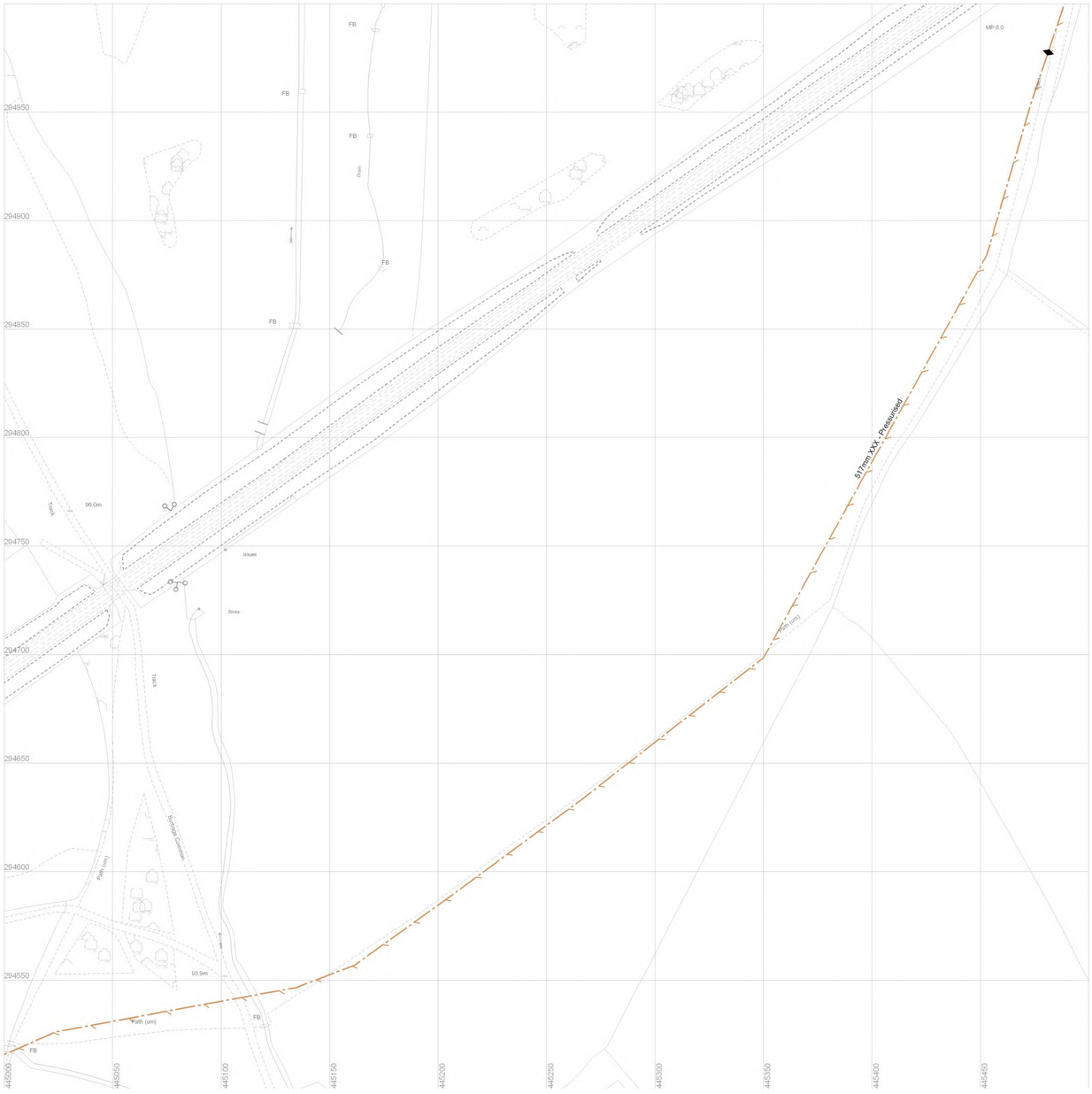
SEWER RECORD (TABULAR)

O/S Map scale: 1:1250
Date of issue: 04.06.19
Sheet No. 1 of 1

This map is centred upon:
O / S Tile reference:
SP4595SE

Disclaimer Statement:
1. Do not scale off this Map.
2. This map and any information supplied with it is furnished as a general guide, is only valid at the date of issue and no warranty as to its correctness is given or implied. In particular this Map and any information shown on it must not be relied upon in the event of any development or works (including but not limited to excavations) in the vicinity of Severn Trent Water's assets or for the purposes of determining the suitability of a point of connection to the sewerage or distribution systems.
3. On **1 October 2011** most private sewers and private lateral drains in Severn Trent Water's sewerage area, which were connected to a public sewer as at 1 July 2011, transferred to the ownership of Severn Trent Water and became public sewers and public lateral drains. A further transfer takes place on 1 October 2012 (date to be confirmed).
Private pumping stations, which form part of these sewers or lateral drains, will transfer to the ownership of Severn Trent Water on or before 1 October 2016.
Severn Trent Water does not possess complete records of these assets.
These assets may not be displayed on this Map.

SP4595SW



SP4594NE

SP4694NE

SP4594SW

- Abandoned Sewer
- Private Combined Gravity Sewer
- Private Foul Gravity Sewer
- Private Surface Water Gravity Sewer
- Public Combined Gravity Sewer
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FV	- FLAP VALVE
BD	- BACK DROP
S	- SIPHON
HD	- HIGHWAY DRAIN
S104	- SECTION 104

SHAPE

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PURPOSE

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SEWER RECORD (TABULAR)

O/S Map scale: 1:1250

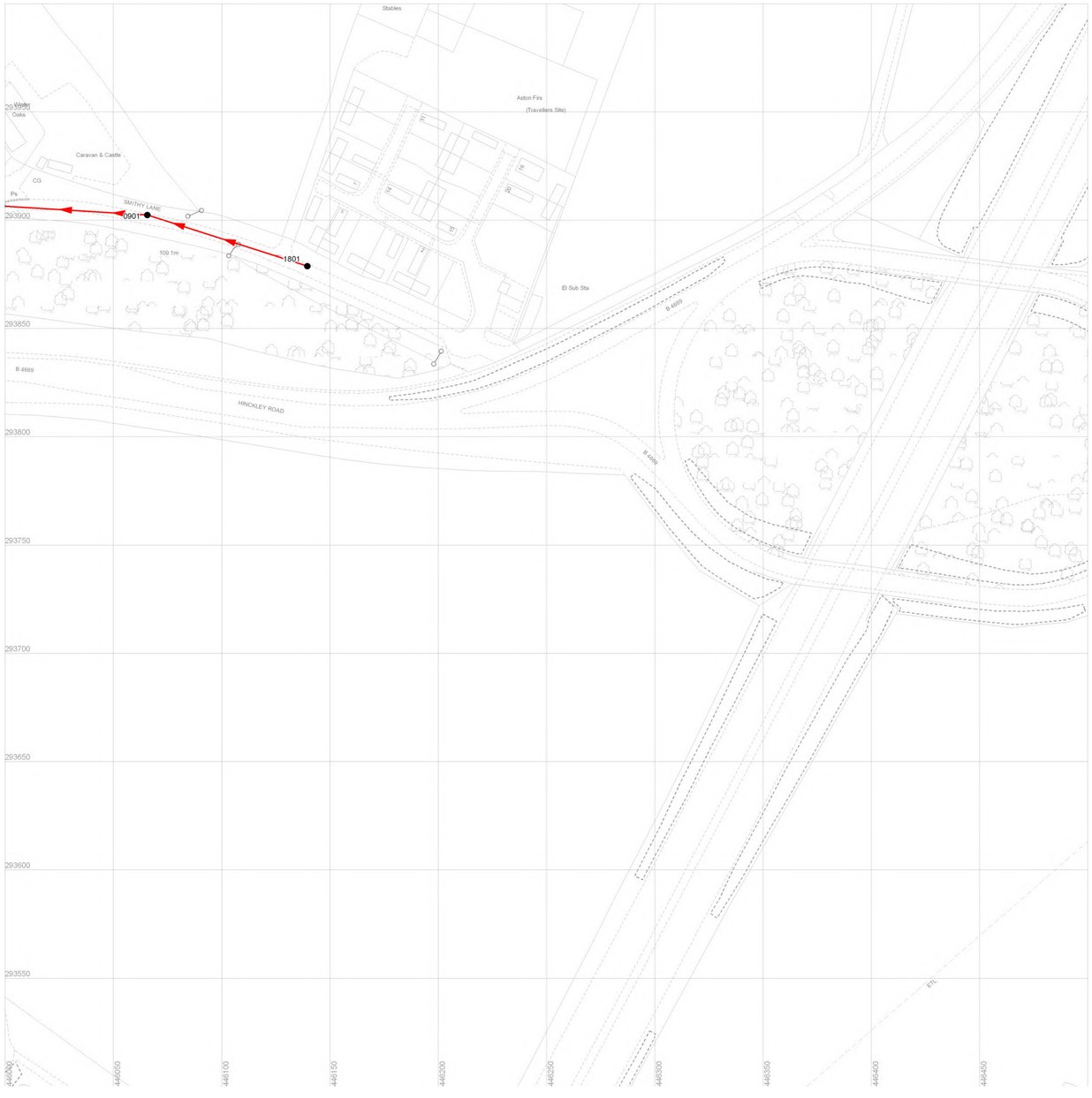
Date of issue: 04.06.19

Sheet No. 1 of 1

This map is centred upon:
O / S Tile reference:

SP4594NW

SP4694SW



SP4693SW

SP4693NE

SP4793NE

Sewer Node / Sewer Pipe Data

REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SP46930901	nil	nil	105.97	C	nil	nil	nil	nil	0.00	nill
SP46931801	nil	nil	nil	C	nil	nil	nil	nil	0.00	nill

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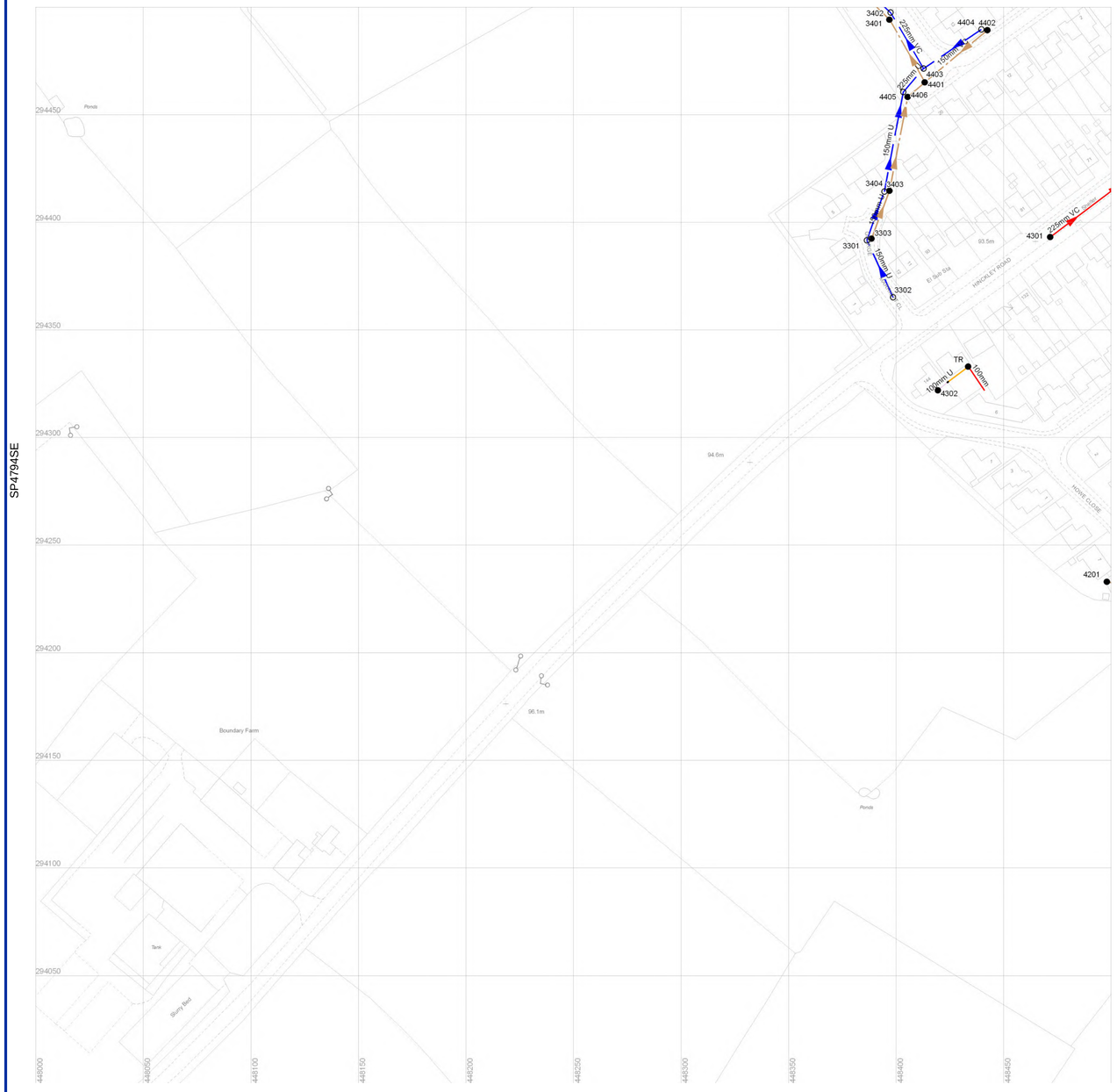
SEWER RECORD (TABULAR)

O/S Map scale: 1:1250
Date of issue: 04.06.19
Sheet No. 1 of 1

This map is centred upon:
O / S Tile reference:
SP4693NW

SP4894NW



SP4793NW

SP4794SE

SP4894SE

SP4893NW

Sewer Node / Sewer Pipe Data

REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SP4894S3301	92.96	91.43	91.01	S	U	C	150	nil	57.71	nill
SP4894S3302	93.47	91.92	91.43	S	U	C	150	nil	59.92	nill
SP4894S3303	92.99	90.98	90.53	F	U	C	150	nil	52.96	nill
SP4894S3401	91.22	88.66	88.35	F	VC	C	225	nil	115.87	1979
SP4894S3402	91.13	88.87	88.73	S	VC	C	225	nil	257.64	1979
SP4894S3403	92.61	91.01	89.25	S	U	C	150	nil	26.91	nill
SP4894S3404	92.50	90.53	90.52	F	U	C	150	nil	4494.00	nill
SP4894S4201	93.09	90.99	90.45	F	VC	C	150	nil	70.09	1979
SP4894S4301	93.52	91.20	90.69	C	VC	C	225	nil	94.49	1914
SP4894S4302	nil	nil	nil	C	U	C	100	nil	0.00	nill
SP4894S4401	91.57	88.79	88.67	F	VC	C	225	nil	278.83	1979
SP4894S4402	91.36	89.00	88.80	F	VC	C	150	nil	190.40	1979
SP4894S4403	91.52	89.13	88.89	S	VC	C	225	nil	127.21	1979
SP4894S4404	91.34	89.35	89.14	S	VC	C	150	nil	158.52	1979
SP4894S4405	91.59	89.09	nil	S	U	C	225	nil	0.15	nill
SP4894S4406	91.60	89.52	88.73	F	U	C	150	nil	12.75	nill
nil	nil	nil	nil	C	nil	nil	nil	nil	0.00	nill

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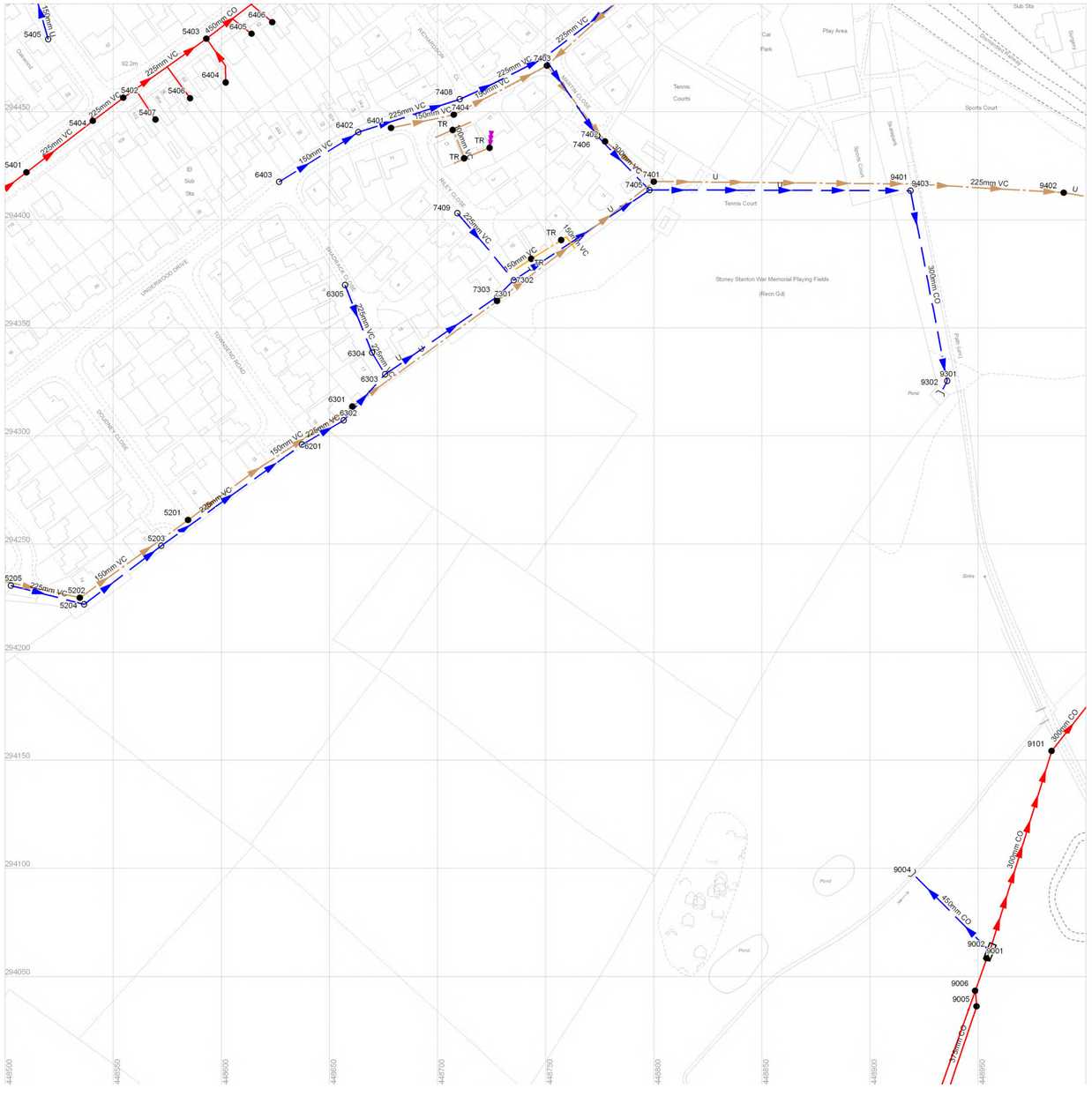
SP4894SW

SP4894NE



SP4893NE

Sewer Node		Sewer Pipe Data								
REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SP4894S201	91.17	89.88	nil	F	VC	C	150	nil	0.00	1979
SP4894S202	92.56	90.42	89.92	F	VC	C	150	nil	123.22	1979
SP4894S203	91.16	90.10	89.52	S	VC	C	225	nil	139.69	1979
SP4894S204	92.59	90.77	90.13	S	VC	C	225	nil	69.69	1979
SP4894S205	93.00	91.00	90.82	S	VC	C	225	nil	195.39	1979
SP4894S401	92.96	90.66	90.33	C	VC	C	nil	nil	117.00	1914
SP4894S402	92.45	90.45	90.26	C	VC	C	nil	nil	248.42	1914
SP4894S403	92.18	90.26	89.93	C	CO	C	nil	nil	145.76	1914
SP4894S404	92.48	90.30	90.47	C	VC	C	nil	nil	0.00	1914
SP4894S405	92.00	90.43	89.45	S	U	C	150	nil	23.27	2003
SP4894S406	nil	nil	nil	C	nil	nil	nil	nil	0.00	nill
SP4894S407	nil	nil	nil	C	nil	nil	nil	nil	0.00	nill
SP4894S201	91.11	89.49	nil	S	VC	C	225	nil	0.00	1979
SP4894S301	nil	nil	nil	F	U	U	nil	nil	0.00	2003
SP4894S302	nil	nil	nil	S	nil	nil	nil	nil	0.00	nill
SP4894S303	nil	nil	87.15	S	U	U	nil	nil	0.00	1979
SP4894S304	90.76	88.64	nil	S	VC	C	225	nil	0.00	2003
SP4894S305	90.55	88.87	88.68	S	VC	C	225	nil	176.95	2003
SP4894S401	90.29	88.06	87.64	F	VC	C	150	nil	71.02	2003
SP4894S402	90.51	88.74	87.82	S	VC	C	225	nil	53.97	2003
SP4894S403	91.37	89.82	88.82	S	VC	C	150	nil	42.72	2003
SP4894S404	nil	nil	nil	C	nil	nil	nil	nil	0.00	nill
SP4894S405	nil	nil	nil	C	nil	nil	nil	nil	0.00	nill
SP4894S406	nil	nil	nil	C	nil	nil	nil	nil	0.00	nill
SP4894T301	nil	nil	nil	F	U	U	nil	nil	0.00	1979
SP4894T302	nil	nil	nil	S	U	U	nil	nil	0.00	1979
SP4894T303	89.40	87.10	nil	S	VC	C	300	nil	0.00	1979
SP4894T401	nil	nil	84.42	F	U	U	nil	nil	0.00	1979
SP4894T402	88.56	86.15	nil	F	VC	C	150	nil	0.00	1979
SP4894T403	89.24	86.68	86.16	F	VC	C	150	nil	85.00	1979
SP4894T404	89.87	87.60	86.72	F	VC	C	150	nil	54.89	1979
SP4894T405	nil	nil	84.05	S	U	U	nil	nil	0.00	1979
SP4894T406	88.58	86.55	nil	S	VC	C	300	nil	0.00	1979
SP4894T407	89.27	87.18	86.57	S	VC	C	300	nil	73.20	1979
SP4894T408	89.89	87.80	87.23	S	VC	C	225	nil	76.11	1979
SP4894T409	89.45	87.74	nil	S	VC	C	225	nil	0.00	1979
SP4894S001	83.57	81.92	81.87	C	CO	C	450	nil	69.00	1979
SP4894S005	83.98	82.20	81.95	C	VC	C	375	nil	30.08	1979
SP4894S006	83.87	81.95	81.92	C	CO	C	450	nil	534.67	1979
SP4894S101	83.20	81.39	80.63	C	CO	C	300	nil	133.78	1979
SP4894S301	83.34	82.11	82.30	S	CO	C	300	nil	0.00	nill
SP4894S401	86.03	84.36	nil	F	VC	C	225	nil	0.00	1979
SP4894S402	nil	nil	82.03	F	U	U	nil	nil	0.00	1979
SP4894S403	86.04	83.94	82.22	S	CO	C	300	nil	52.11	1979
nil	nil	nil	nil	F	VC	nil	nil	nil	0.00	nill
nil	nil	nil	nil	F	VC	nil	nil	nil	0.00	nill
nil	nil	nil	nil	F	VC	nil	nil	nil	0.00	nill

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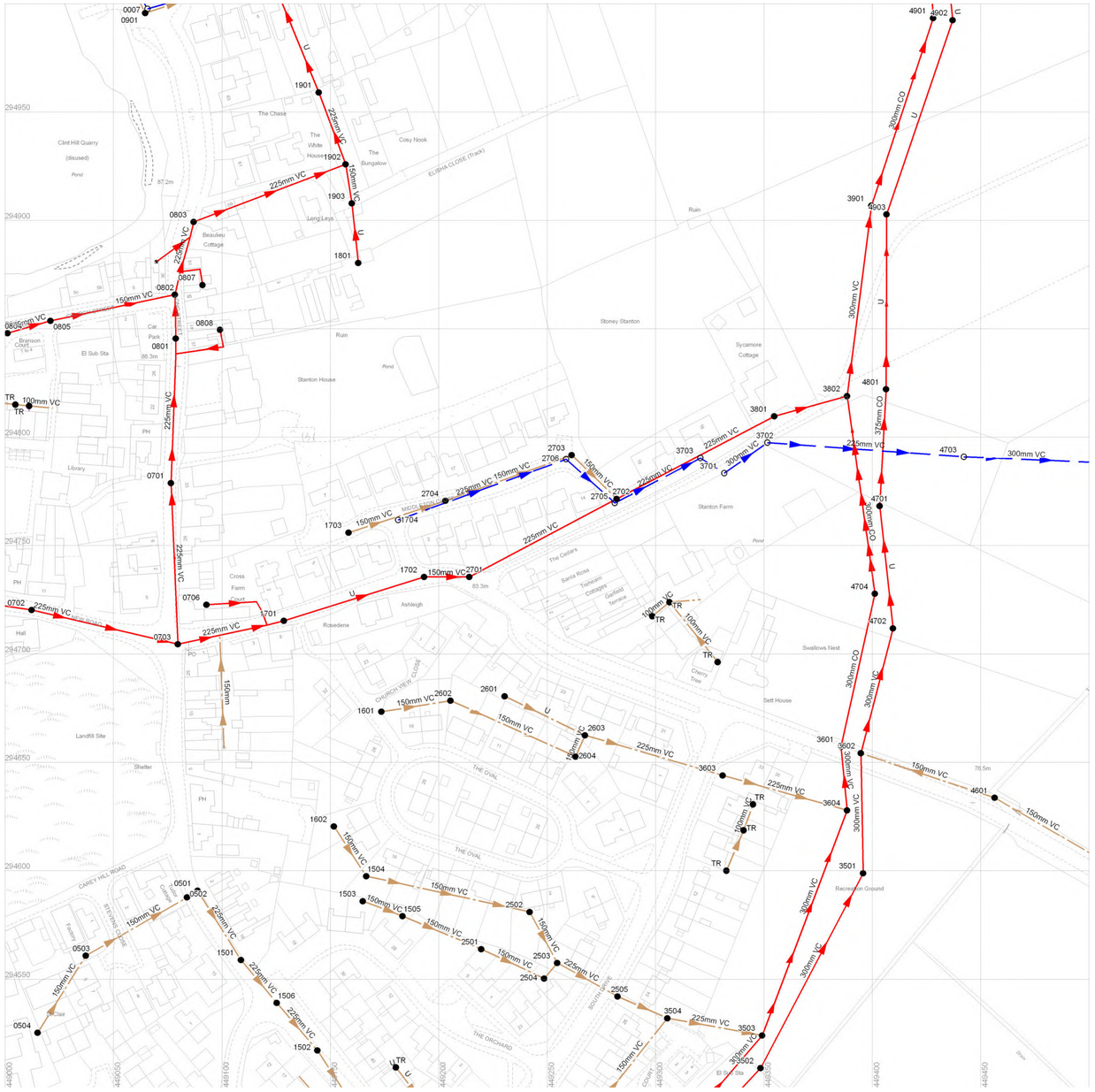
SEWER RECORD (TABULAR)

O/S Map scale: 1:250
Date of issue: 04.06.19
Sheet No. 1 of 1

This map is centred upon:
O / S Tile reference:
SP4894SE

SP4995SW



Sewer Node / Sewer Pipe Data

REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SP49940007	82.21	75.76	75.44	S	nil	C	675	nil	315.50	nill
SP49940501	88.50	86.71	84.28	F	VC	C	225	nil	15.53	1979
SP49940502	88.67	87.37	86.74	F	VC	C	150	nil	9.25	1979
SP49940503	90.57	88.44	87.40	F	VC	C	150	nil	52.12	1979
SP49940504	90.44	89.33	88.45	F	VC	C	150	nil	47.94	1979
SP49940701	89.21	88.25	86.40	C	VC	C	225	nil	36.25	1979
SP49940702	92.67	90.53	88.44	C	VC	C	225	nil	32.96	1979
SP49940703	90.20	88.44	nil	C	VC	C	225	nil	0.00	1979
SP49940703	90.20	88.39	nil	C	VC	C	225	nil	0.00	1914
SP49940706	nil	nil	nil	C	nil	nil	nil	nil	0.00	nill
SP49940801	88.24	86.36	86.10	C	VC	C	225	nil	77.00	1979
SP49940802	87.95	86.00	85.39	C	VC	C	225	nil	56.08	1979
SP49940803	87.31	85.32	82.04	C	VC	C	225	nil	22.77	1979
SP49940804	91.95	90.34	89.31	C	VC	C	150	nil	18.14	1979
SP49940805	91.08	89.30	86.12	C	VC	C	150	nil	18.63	1979
SP49940807	nil	nil	nil	C	nil	nil	nil	nil	0.00	nill
SP49940808	nil	nil	nil	C	nil	nil	nil	nil	0.00	nill
SP49940901	82.28	75.73	75.46	F	nil	C	375	nil	373.93	nill
SP49941501	86.07	84.24	82.97	F	VC	C	225	nil	19.56	1979
SP49941502	83.36	81.54	80.46	F	VC	C	225	nil	32.10	1979
SP49941503	85.99	84.50	83.57	F	VC	C	nil	nil	19.76	1979
SP49941504	85.59	84.21	80.33	F	VC	C	150	nil	20.27	1979
SP49941505	85.26	83.54	81.19	F	VC	C	nil	nil	16.99	1979
SP49941506	84.56	82.95	81.58	F	VC	C	225	nil	21.22	1979
SP49941601	85.84	85.01	83.04	F	VC	C	150	nil	16.44	1979
SP49941602	86.96	85.58	84.25	F	VC	C	150	nil	20.65	1979
SP49941701	87.17	nil	82.27	C	U	U	nil	nil	0.00	1914
SP49941702	84.04	82.20	81.46	C	VC	C	150	nil	28.38	1979
SP49941703	86.13	84.51	82.42	F	VC	C	150	nil	22.69	2003
SP49941704	85.01	83.68	80.24	S	VC	C	225	nil	24.09	1979
SP49941801	nil	nil	82.52	C	U	U	nil	nil	0.00	1979
SP49941901	nil	nil	79.63	C	U	U	nil	nil	0.00	1979
SP49941902	83.80	82.02	nil	C	VC	C	225	nil	0.00	1979
SP49941903	84.17	82.22	82.03	C	VC	C	150	nil	90.84	1979
SP49942501	82.84	81.18	79.53	F	VC	C	nil	nil	19.26	1979
SP49942502	81.58	80.28	79.31	F	VC	C	nil	nil	27.22	1979
SP49942503	80.42	79.22	77.63	F	VC	C	nil	nil	20.53	1979
SP49942504	80.98	79.49	79.38	F	VC	C	150	nil	71.00	nill
SP49942505	79.73	77.59	76.84	F	VC	C	nil	nil	34.05	1979
SP49942601	nil	nil	79.55	F	U	U	nil	nil	0.00	1979
SP49942602	84.09	83.03	80.37	F	VC	C	150	nil	23.89	1979
SP49942603	81.14	79.55	77.01	F	VC	C	225	nil	26.56	1979
SP49942604	81.61	80.36	79.55	F	VC	C	150	nil	13.30	1979
SP49942701	83.33	81.44	78.88	C	VC	C	225	nil	30.40	1979
SP49942702	80.55	78.86	nil	C	VC	C	225	nil	0.00	1979
SP49942703	81.56	80.06	78.98	F	VC	C	150	nil	26.85	1979
SP49942704	84.10	82.40	80.11	F	VC	C	150	nil	27.35	1979
SP49942705	80.52	79.21	78.19	S	VC	C	225	nil	44.29	1979
SP49942706	81.64	80.22	79.31	S	VC	C	225	nil	33.49	1979
SP49943501	77.12	76.02	75.73	C	VC	C	300	nil	189.69	1979
SP49943502	77.36	76.37	76.04	C	VC	C	300	nil	309.09	1979
SP49943503	77.59	76.49	75.93	C	VC	C	300	nil	198.98	1979
SP49943504	78.43	76.80	76.57	F	VC	C	225	nil	188.04	1979
SP49943601	77.63	75.80	75.61	C	CO	C	300	nil	377.95	1979
SP49943602	77.36	75.72	nil	C	VC	C	300	nil	0.00	1979
SP49943603	78.86	77.00	76.12	F	VC	C	225	nil	67.27	1979
SP49943604	77.17	75.90	75.81	C	VC	C	300	nil	323.89	1979
SP49943701	78.68	77.73	77.05	S	VC	C	300	nil	35.90	1979
SP49943702	77.69	77.01	74.69	S	VC	C	225	nil	38.91	1979
SP49943703	78.85	78.16	77.91	S	VC	C	225	nil	52.16	nill
SP49943801	nil	nil	75.46	C	nil	nil	nil	nil	0.00	nill
SP49943802	77.02	75.29	75.13	C	VC	C	300	nil	554.25	1979
SP49943901	76.95	75.13	nil	C	CO	C	300	nil	0.00	1979
SP49944601	76.90	76.10	75.84	F	VC	C	150	nil	246.92	1979
SP49944701	76.71	75.42	nil	C	CO	C	375	nil	0.00	1979
SP49944702	nil	nil	75.43	C	U	U	nil	nil	0.00	1979
SP49944703	75.53	74.66	74.35	S	VC	C	300	nil	213.13	1979
SP49944704	76.87	75.60	75.31	C	CO	C	300	nil	316.97	1979
SP49944801	nil	nil	nil	C	U	U	nil	nil	0.00	1979
SP49944901	nil	nil	nil	C	CO	C	300	nil	0.00	1979
SP49944902	nil	nil	nil	C	U	U	nil	nil	0.00	1979
SP49944903	nil	nil	nil	C	U	U	nil	nil	0.00	1979
nil	nil	nil	nil	F	VC	nil	nil	nil	0.00	nill
nil	nil	nil	nil	F	U	nil	nil	nil	0.00	nill
nil	nil	nil	nil	F	VC	nil	nil	nil	0.00	nill
nil	nil	nil	nil	F	VC	nil	nil	nil	0.00	nill
nil	nil	nil	nil	F	VC	nil	nil	nil	0.00	nill
nil	nil	nil	nil	F	VC	nil	nil	nil	0.00	nill

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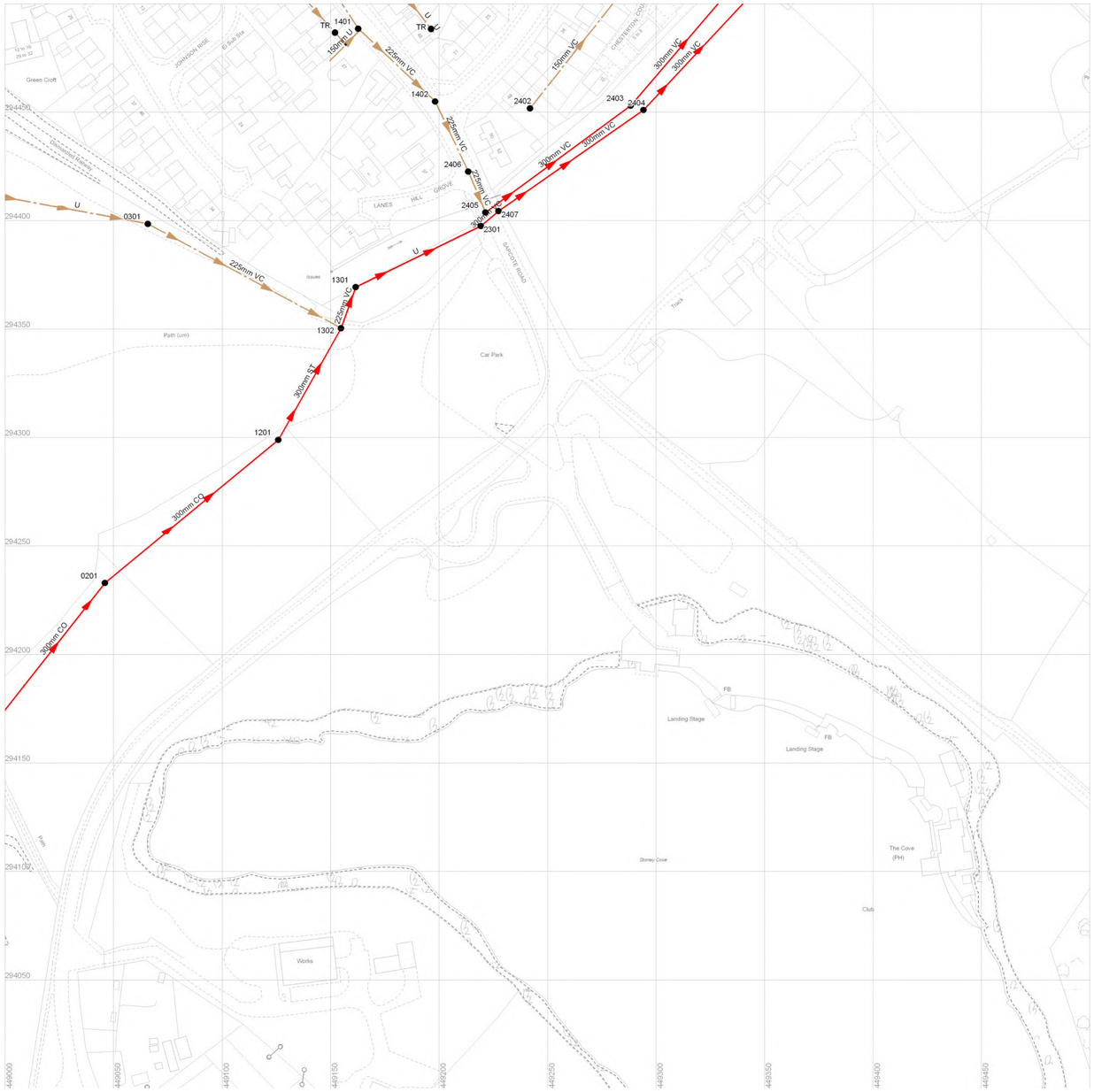
O/S Map scale: 1:1250
Date of issue: 04.06.19
Sheet No. 1 of 1

This map is centred upon:
O / S Tile reference:

SP4994NW

SP4994NW



SP4893NW

SP4894SE

SP4994SE

Sewer Node / Sewer Pipe Data

REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SP49940201	82.10	80.62	79.85	C	CO	C	nil	nil	134.69	1979
SP49940301	84.69	82.01	79.67	F	VC	C	225	nil	43.21	1979
SP49941201	81.36	79.84	79.66	C	ST	C	300	nil	328.11	nill
SP49941301	nil	nil	78.04	C	U	U	nil	nil	0.00	1979
SP49941302	81.25	79.56	nil	C	VC	C	225	nil	0.00	1979
SP49941401	82.17	80.41	79.10	F	VC	C	225	nil	36.72	1979
SP49941402	80.83	79.05	78.37	F	VC	C	225	nil	53.93	1979
SP49942301	79.91	77.89	77.79	C	VC	C	300	nil	104.20	1979
SP49942402	79.61	78.82	76.91	F	VC	C	150	nil	53.80	1979
SP49942403	77.87	76.73	76.51	C	VC	C	300	nil	425.50	1979
SP49942404	77.87	76.80	76.39	C	VC	C	300	nil	193.29	1979
SP49942405	79.92	77.72	76.75	C	VC	C	300	nil	84.13	1979
SP49942406	80.04	78.36	78.00	F	VC	C	225	nil	54.72	1979
SP49942407	79.99	77.77	76.81	C	VC	C	300	nil	83.36	1979
nil	nil	nil	nil	F	U	nil	nil	nil	0.00	nill

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O/S Map scale: 1:1250
Date of issue: 04.06.19
Sheet No. 1 of 1

This map is centred upon:
O / S Tile reference:
SP4994SW

APPENDICES

Appendix 5: Greenfield Runoff Rate Calculations

IH 124 Mean Annual Flood

Input

Return Period (years)	2	Soil	0.450
Area (ha)	102.100	Urban	0.000
SAAR (mm)	700	Region Number	Region 4

Results	**l/s**
QBAR Rural	414.7
QBAR Urban	414.7
Q2 years	371.6
Q1 year	344.2
Q2 years	371.6
Q5 years	510.0
Q10 years	617.8
Q20 years	737.0
Q25 years	778.7
Q30 years	812.5
Q50 years	913.1
Q100 years	1065.7
Q200 years	1252.3
Q250 years	1314.5
Q1000 years	1725.0

IH 124 Mean Annual Flood

Input

Return Period (years)	2	Soil	0.450
Area (ha)	89.800	Urban	0.000
SAAR (mm)	700	Region Number	Region 4

Results	**l/s**
QBAR Rural	369.9
QBAR Urban	369.9
Q2 years	331.5
Q1 year	307.0
Q2 years	331.5
Q5 years	455.0
Q10 years	551.1
Q20 years	657.4
Q25 years	694.7
Q30 years	724.7
Q50 years	814.5
Q100 years	950.6
Q200 years	1117.1
Q250 years	1172.6
Q1000 years	1538.8

APPENDICES

Appendix 6: Greenfield Runoff Volume Calculation

Greenfield Runoff Volume

FSR Data

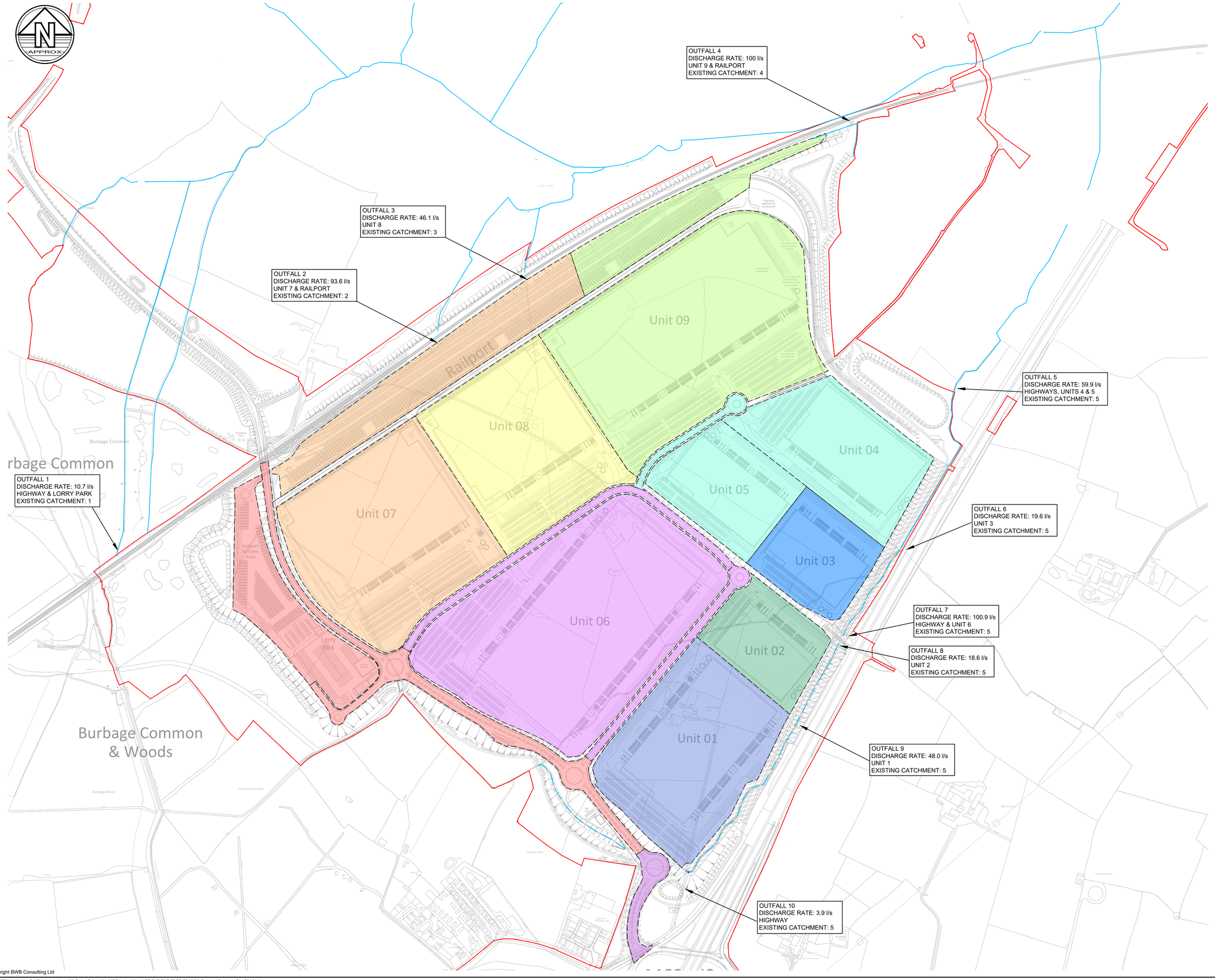
Return Period (years)	100
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	19.800
Ratio R	0.400
Areal Reduction Factor	1.00
Area (ha)	191.000
SAAR (mm)	700
CWI	105.000
Urban	0.000
SPR	47.000

Results

Percentage Runoff (%)	45.91
Greenfield Runoff Volume (m^3)	54342.670

APPENDICES

Appendix 7: Proposed Catchment Plan



Notes

1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.
5. Drawing provided for illustrative purposes only. Design subject to further coordination and approvals.
6. Layout based on AJA drawing: 5905-177.
7. Attenuation indicatively sized for the 1 in 100 year storm event plus a 25% allowance for climate change for the estimated impermeable areas. Allowance made for 650m^3 storage per 1ha of impermeable area. To be agreed with the LLFA.
8. Equivalent greenfield runoff rates have been estimate to be 4.1 l/s/ha. To be agreed with the LLFA.

Legend

CATCHMENT & OUTFALL SUMMARY			
REFERNCE		CONTRIBUTING AREA (ha)	DISCHARGE RATE (l/s)
1		9.16	10.7
2		22.45	92.0
3		11.90	46.1
4		24.39	100.0
5		14.62	59.9
6		4.77	19.6
7		24.63	100.9
8		4.54	18.6
9		11.71	48.0
10		0.95	3.9

Rev	Date	Details of issue / revision	Drw	Rev
P04	05.09.22	Updated to latest masterplan	RJ	CD
P03	14.12.21	Updated to latest masterplan	RJ	CD
P02	01.10.21	Updated to latest masterplan	RJ	CD
P01	25.05.21	Preliminary Issue	RJ	CD

Issues & Revisions

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Client

TRITAX SYMMETRY

Project Title

HINCKLEY RAIL FREIGHT INTERCHANGE

Drawing Title

PROPOSED CATCHMENT PLAN

Drawn:	RJ	Reviewed:	CD	
BWB Ref:	NTT 2814	Date:	25.05.21	Scale@A1: 1:4000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
HRF-BWB-EWE-ZZ-DR-CD-00503	S2	P04

X:\NTT\NTT2814_Hinckley Rail Freight Interchange\02. Project Delivery\01. WIP\Drawings\Water\HRF-BWB-EWE-ZZ-DR-CD-00503_Proposed Catchment Plan P04.01.dwg

APPENDICES

Appendix 8: Source Control Calculations

Summary of Results for 100 year Return Period (+25%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	99.112	0.412	4.1	225.5	O K
30 min Summer	99.221	0.521	4.1	294.9	O K
60 min Summer	99.326	0.626	4.1	365.2	O K
120 min Summer	99.431	0.731	4.1	440.2	O K
180 min Summer	99.491	0.791	4.1	485.4	O K
240 min Summer	99.530	0.830	4.1	515.3	O K
360 min Summer	99.574	0.874	4.1	549.2	O K
480 min Summer	99.591	0.891	4.1	563.2	O K
600 min Summer	99.596	0.896	4.1	567.0	O K
720 min Summer	99.593	0.893	4.1	564.8	O K
960 min Summer	99.575	0.875	4.1	550.1	O K
1440 min Summer	99.525	0.825	4.1	511.3	O K
2160 min Summer	99.462	0.762	4.1	463.2	O K
2880 min Summer	99.409	0.709	4.1	424.6	O K
4320 min Summer	99.318	0.618	4.1	359.6	O K
5760 min Summer	99.235	0.535	4.1	303.5	O K
7200 min Summer	99.171	0.471	4.1	262.4	O K
8640 min Summer	99.119	0.419	4.1	229.8	O K
10080 min Summer	99.077	0.377	4.1	204.0	O K
15 min Winter	99.156	0.456	4.1	252.9	O K
30 min Winter	99.276	0.576	4.1	330.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	121.903	0.0	218.8	19
30 min Summer	80.162	0.0	284.3	34
60 min Summer	50.146	0.0	371.4	64
120 min Summer	30.797	0.0	455.4	124
180 min Summer	23.054	0.0	510.0	184
240 min Summer	18.681	0.0	549.1	242
360 min Summer	13.737	0.0	599.2	362
480 min Summer	10.934	0.0	624.3	482
600 min Summer	9.112	0.0	631.3	602
720 min Summer	7.828	0.0	628.4	722
960 min Summer	6.126	0.0	617.2	960
1440 min Summer	4.308	0.0	589.1	1210
2160 min Summer	3.022	0.0	812.5	1576
2880 min Summer	2.358	0.0	844.6	1988
4320 min Summer	1.682	0.0	901.0	2808
5760 min Summer	1.338	0.0	962.4	3568
7200 min Summer	1.134	0.0	1019.0	4320
8640 min Summer	0.999	0.0	1076.3	5016
10080 min Summer	0.903	0.0	1134.1	5752
15 min Winter	121.903	0.0	244.5	19
30 min Winter	80.162	0.0	312.5	33

Summary of Results for 100 year Return Period (+25%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	99.389	0.689	4.1	410.2	O K
120 min Winter	99.504	0.804	4.1	495.1	O K
180 min Winter	99.571	0.871	4.1	546.9	O K
240 min Winter	99.614	0.914	4.1	581.6	O K
360 min Winter	99.664	0.964	4.1	621.9	O K
480 min Winter	99.686	0.986	4.1	640.1	O K
600 min Winter	99.694	0.994	4.1	646.9	O K
720 min Winter	99.694	0.994	4.1	646.9	O K
960 min Winter	99.680	0.980	4.1	635.3	O K
1440 min Winter	99.629	0.929	4.1	593.8	O K
2160 min Winter	99.554	0.854	4.1	533.3	O K
2880 min Winter	99.488	0.788	4.1	482.7	O K
4320 min Winter	99.367	0.667	4.1	394.2	O K
5760 min Winter	99.236	0.536	4.1	304.5	O K
7200 min Winter	99.134	0.434	4.1	239.1	O K
8640 min Winter	99.053	0.353	4.1	189.6	O K
10080 min Winter	98.990	0.290	4.1	152.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	50.146	0.0	415.7	64
120 min Winter	30.797	0.0	508.8	122
180 min Winter	23.054	0.0	568.1	180
240 min Winter	18.681	0.0	607.9	240
360 min Winter	13.737	0.0	642.6	356
480 min Winter	10.934	0.0	642.3	472
600 min Winter	9.112	0.0	638.0	588
720 min Winter	7.828	0.0	632.8	702
960 min Winter	6.126	0.0	621.8	924
1440 min Winter	4.308	0.0	598.4	1344
2160 min Winter	3.022	0.0	909.6	1668
2880 min Winter	2.358	0.0	945.3	2136
4320 min Winter	1.682	0.0	1005.5	3068
5760 min Winter	1.338	0.0	1078.1	3816
7200 min Winter	1.134	0.0	1141.5	4544
8640 min Winter	0.999	0.0	1205.8	5272
10080 min Winter	0.903	0.0	1270.9	5952

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 446317 295054 SP 46317 95054
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+25

Time Area Diagram

Total Area (ha) 1.000

Time (mins) From:	To:	Area (ha)
0	4	1.000

Model Details

Storage is Online Cover Level (m) 100.000

Tank or Pond Structure

Invert Level (m) 98.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	480.0	0.400	612.3	0.800	760.7	1.200	925.2
0.100	511.6	0.500	647.9	0.900	800.3	1.300	968.8
0.200	544.1	0.600	684.5	1.000	840.9		
0.300	577.7	0.700	722.1	1.100	882.5		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0096-4100-1000-4100
Design Head (m)	1.000
Design Flow (l/s)	4.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	96
Invert Level (m)	98.700
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	4.1
Flush-Flo™	0.294	4.1
Kick-Flo®	0.629	3.3
Mean Flow over Head Range	-	3.6

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	3.1	1.200	4.5	3.000	6.8	7.000	10.2
0.200	4.0	1.400	4.8	3.500	7.4	7.500	10.6
0.300	4.1	1.600	5.1	4.000	7.8	8.000	10.9
0.400	4.0	1.800	5.4	4.500	8.3	8.500	11.2
0.500	3.9	2.000	5.7	5.000	8.7	9.000	11.5
0.600	3.5	2.200	5.9	5.500	9.1	9.500	11.8
0.800	3.7	2.400	6.2	6.000	9.5		
1.000	4.1	2.600	6.4	6.500	9.9		

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	99.096	0.396	4.1	215.3	O K
30 min Summer	99.200	0.500	4.1	281.2	O K
60 min Summer	99.301	0.601	4.1	348.0	O K
120 min Summer	99.393	0.693	4.1	412.6	O K
180 min Summer	99.439	0.739	4.1	446.0	O K
240 min Summer	99.466	0.766	4.1	466.1	O K
360 min Summer	99.496	0.796	4.1	488.8	O K
480 min Summer	99.511	0.811	4.1	500.7	O K
600 min Summer	99.518	0.818	4.1	505.9	O K
720 min Summer	99.519	0.819	4.1	506.8	O K
960 min Summer	99.512	0.812	4.1	500.8	O K
1440 min Summer	99.484	0.784	4.1	480.1	O K
2160 min Summer	99.444	0.744	4.1	449.7	O K
2880 min Summer	99.404	0.704	4.1	420.6	O K
4320 min Summer	99.320	0.620	4.1	361.0	O K
5760 min Summer	99.231	0.531	4.1	301.1	O K
7200 min Summer	99.153	0.453	4.1	250.7	O K
8640 min Summer	99.084	0.384	4.1	207.9	O K
10080 min Summer	99.024	0.324	4.1	172.2	O K
15 min Winter	99.138	0.438	4.1	241.5	O K
30 min Winter	99.253	0.553	4.1	315.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	116.472	0.0	209.2	19
30 min Summer	76.493	0.0	272.4	34
60 min Summer	47.860	0.0	354.5	64
120 min Summer	28.933	0.0	428.1	124
180 min Summer	21.268	0.0	471.4	182
240 min Summer	16.995	0.0	501.4	242
360 min Summer	12.340	0.0	543.9	362
480 min Summer	9.835	0.0	574.6	482
600 min Summer	8.241	0.0	596.6	602
720 min Summer	7.130	0.0	610.7	720
960 min Summer	5.669	0.0	613.3	960
1440 min Summer	4.097	0.0	586.9	1194
2160 min Summer	2.956	0.0	794.6	1560
2880 min Summer	2.342	0.0	838.9	1988
4320 min Summer	1.685	0.0	902.8	2808
5760 min Summer	1.333	0.0	958.6	3528
7200 min Summer	1.111	0.0	998.1	4256
8640 min Summer	0.956	0.0	1030.8	5008
10080 min Summer	0.843	0.0	1058.0	5656
15 min Winter	116.472	0.0	233.9	19
30 min Winter	76.493	0.0	301.2	33

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	99.363	0.663	4.1	391.1	O K
120 min Winter	99.463	0.763	4.1	464.2	O K
180 min Winter	99.514	0.814	4.1	502.7	O K
240 min Winter	99.544	0.844	4.1	526.2	O K
360 min Winter	99.580	0.880	4.1	553.9	O K
480 min Winter	99.599	0.899	4.1	569.5	O K
600 min Winter	99.610	0.910	4.1	577.7	O K
720 min Winter	99.614	0.914	4.1	581.1	O K
960 min Winter	99.611	0.911	4.1	578.9	O K
1440 min Winter	99.583	0.883	4.1	556.6	O K
2160 min Winter	99.533	0.833	4.1	517.4	O K
2880 min Winter	99.481	0.781	4.1	477.9	O K
4320 min Winter	99.369	0.669	4.1	395.7	O K
5760 min Winter	99.231	0.531	4.1	301.5	O K
7200 min Winter	99.113	0.413	4.1	225.7	O K
8640 min Winter	99.013	0.313	4.1	166.2	O K
10080 min Winter	98.937	0.237	4.1	122.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	47.860	0.0	396.9	64
120 min Winter	28.933	0.0	478.7	122
180 min Winter	21.268	0.0	526.3	180
240 min Winter	16.995	0.0	558.8	240
360 min Winter	12.340	0.0	602.2	356
480 min Winter	9.835	0.0	626.8	472
600 min Winter	8.241	0.0	632.4	588
720 min Winter	7.130	0.0	629.0	700
960 min Winter	5.669	0.0	618.1	924
1440 min Winter	4.097	0.0	593.8	1340
2160 min Winter	2.956	0.0	889.7	1668
2880 min Winter	2.342	0.0	939.0	2132
4320 min Winter	1.685	0.0	1007.4	3068
5760 min Winter	1.333	0.0	1073.7	3808
7200 min Winter	1.111	0.0	1118.1	4536
8640 min Winter	0.956	0.0	1154.8	5184
10080 min Winter	0.843	0.0	1185.7	5840

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.700	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+20

Time Area Diagram

Total Area (ha) 1.000

Time (mins) From:	To:	Area (ha)
0	4	1.000

Model Details

Storage is Online Cover Level (m) 100.000

Tank or Pond Structure

Invert Level (m) 98.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	480.0	0.400	612.3	0.800	760.7	1.200	925.2
0.100	511.6	0.500	647.9	0.900	800.3	1.300	968.8
0.200	544.1	0.600	684.5	1.000	840.9		
0.300	577.7	0.700	722.1	1.100	882.5		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0096-4100-1000-4100
Design Head (m)	1.000
Design Flow (l/s)	4.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	96
Invert Level (m)	98.700
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	4.1
Flush-Flo™	0.294	4.1
Kick-Flo®	0.629	3.3
Mean Flow over Head Range	-	3.6

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	3.1	1.200	4.5	3.000	6.8	7.000	10.2
0.200	4.0	1.400	4.8	3.500	7.4	7.500	10.6
0.300	4.1	1.600	5.1	4.000	7.8	8.000	10.9
0.400	4.0	1.800	5.4	4.500	8.3	8.500	11.2
0.500	3.9	2.000	5.7	5.000	8.7	9.000	11.5
0.600	3.5	2.200	5.9	5.500	9.1	9.500	11.8
0.800	3.7	2.400	6.2	6.000	9.5		
1.000	4.1	2.600	6.4	6.500	9.9		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	99.156	0.456	4.1	252.9	O K
30 min Summer	99.276	0.576	4.1	331.0	O K
60 min Summer	99.390	0.690	4.1	410.3	O K
120 min Summer	99.504	0.804	4.1	494.9	O K
180 min Summer	99.570	0.870	4.1	546.3	O K
240 min Summer	99.613	0.913	4.1	580.7	O K
360 min Summer	99.662	0.962	4.1	620.5	O K
480 min Summer	99.683	0.983	4.1	638.0	O K
600 min Summer	99.690	0.990	4.1	644.0	O K
720 min Summer	99.690	0.990	4.1	643.3	O K
960 min Summer	99.673	0.973	4.1	629.9	O K
1440 min Summer	99.623	0.923	4.1	588.8	O K
2160 min Summer	99.558	0.858	4.1	537.1	O K
2880 min Summer	99.506	0.806	4.1	496.9	O K
4320 min Summer	99.424	0.724	4.1	435.4	O K
5760 min Summer	99.354	0.654	4.1	385.3	O K
7200 min Summer	99.285	0.585	4.1	337.5	O K
8640 min Summer	99.229	0.529	4.1	299.8	O K
10080 min Summer	99.183	0.483	4.1	269.9	O K
15 min Winter	99.204	0.504	4.1	283.5	O K
30 min Winter	99.335	0.635	4.1	371.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	136.531	0.0	244.5	19
30 min Summer	89.782	0.0	312.5	34
60 min Summer	56.163	0.0	415.7	64
120 min Summer	34.492	0.0	508.8	124
180 min Summer	25.821	0.0	568.1	184
240 min Summer	20.923	0.0	608.0	242
360 min Summer	15.386	0.0	643.0	362
480 min Summer	12.246	0.0	643.0	482
600 min Summer	10.205	0.0	638.9	602
720 min Summer	8.767	0.0	633.9	722
960 min Summer	6.861	0.0	623.0	960
1440 min Summer	4.825	0.0	598.9	1242
2160 min Summer	3.385	0.0	909.6	1604
2880 min Summer	2.641	0.0	945.1	2016
4320 min Summer	1.884	0.0	1002.9	2852
5760 min Summer	1.499	0.0	1078.0	3688
7200 min Summer	1.270	0.0	1141.5	4464
8640 min Summer	1.118	0.0	1205.7	5184
10080 min Summer	1.012	0.0	1270.6	5944
15 min Winter	136.531	0.0	272.4	19
30 min Winter	89.782	0.0	330.3	34

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	99.458	0.758	4.1	460.5	O K
120 min Winter	99.583	0.883	4.1	556.5	O K
180 min Winter	99.656	0.956	4.1	615.4	O K
240 min Winter	99.704	1.004	4.1	655.2	Flood Risk
360 min Winter	99.759	1.059	4.2	702.4	Flood Risk
480 min Winter	99.785	1.085	4.3	724.8	Flood Risk
600 min Winter	99.795	1.095	4.3	734.2	Flood Risk
720 min Winter	99.797	1.097	4.3	736.0	Flood Risk
960 min Winter	99.786	1.086	4.3	726.3	Flood Risk
1440 min Winter	99.739	1.039	4.2	685.6	Flood Risk
2160 min Winter	99.662	0.962	4.1	620.8	O K
2880 min Winter	99.599	0.899	4.1	569.0	O K
4320 min Winter	99.487	0.787	4.1	482.4	O K
5760 min Winter	99.386	0.686	4.1	407.6	O K
7200 min Winter	99.275	0.575	4.1	330.2	O K
8640 min Winter	99.180	0.480	4.1	268.3	O K
10080 min Winter	99.106	0.406	4.1	221.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	56.163	0.0	465.0	64
120 min Winter	34.492	0.0	567.0	122
180 min Winter	25.821	0.0	626.1	180
240 min Winter	20.923	0.0	649.8	240
360 min Winter	15.386	0.0	651.0	356
480 min Winter	12.246	0.0	648.0	474
600 min Winter	10.205	0.0	644.6	590
720 min Winter	8.767	0.0	641.1	704
960 min Winter	6.861	0.0	633.5	930
1440 min Winter	4.825	0.0	618.2	1356
2160 min Winter	3.385	0.0	1017.9	1692
2880 min Winter	2.641	0.0	1056.8	2160
4320 min Winter	1.884	0.0	1101.8	3072
5760 min Winter	1.499	0.0	1207.4	3976
7200 min Winter	1.270	0.0	1278.6	4760
8640 min Winter	1.118	0.0	1350.7	5456
10080 min Winter	1.012	0.0	1423.8	6160

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 446317 295054 SP 46317 95054
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.000

Time (mins) From:	To:	Area (ha)
0	4	1.000

Model Details

Storage is Online Cover Level (m) 100.000

Tank or Pond Structure

Invert Level (m) 98.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	480.0	0.400	612.3	0.800	760.7	1.200	925.2
0.100	511.6	0.500	647.9	0.900	800.3	1.300	968.8
0.200	544.1	0.600	684.5	1.000	840.9		
0.300	577.7	0.700	722.1	1.100	882.5		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0096-4100-1000-4100
Design Head (m)	1.000
Design Flow (l/s)	4.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	96
Invert Level (m)	98.700
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	4.1
Flush-Flo™	0.294	4.1
Kick-Flo®	0.629	3.3
Mean Flow over Head Range	-	3.6

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	3.1	1.200	4.5	3.000	6.8	7.000	10.2
0.200	4.0	1.400	4.8	3.500	7.4	7.500	10.6
0.300	4.1	1.600	5.1	4.000	7.8	8.000	10.9
0.400	4.0	1.800	5.4	4.500	8.3	8.500	11.2
0.500	3.9	2.000	5.7	5.000	8.7	9.000	11.5
0.600	3.5	2.200	5.9	5.500	9.1	9.500	11.8
0.800	3.7	2.400	6.2	6.000	9.5		
1.000	4.1	2.600	6.4	6.500	9.9		

Summary of Results for 100 year Return Period (+25%)

Half Drain Time : 1472 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	8.328	0.328	0.0	45.3	45.3	2683.4	O K
30 min Summer	8.430	0.430	0.0	46.1	46.1	3514.7	O K
60 min Summer	8.534	0.534	0.0	46.1	46.1	4362.3	O K
120 min Summer	8.647	0.647	0.0	46.1	46.1	5283.4	O K
180 min Summer	8.717	0.717	0.0	46.1	46.1	5857.1	O K
240 min Summer	8.765	0.765	0.0	46.1	46.1	6253.3	O K
360 min Summer	8.824	0.824	0.0	46.1	46.1	6735.7	O K
480 min Summer	8.854	0.854	0.0	46.1	46.1	6973.5	O K
600 min Summer	8.867	0.867	0.0	46.1	46.1	7084.6	O K
720 min Summer	8.872	0.872	0.0	46.1	46.1	7121.3	O K
960 min Summer	8.864	0.864	0.0	46.1	46.1	7061.1	O K
1440 min Summer	8.827	0.827	0.0	46.1	46.1	6757.8	O K
2160 min Summer	8.775	0.775	0.0	46.1	46.1	6331.1	O K
2880 min Summer	8.727	0.727	0.0	46.1	46.1	5942.7	O K
4320 min Summer	8.650	0.650	0.0	46.1	46.1	5308.4	O K
5760 min Summer	8.586	0.586	0.0	46.1	46.1	4789.2	O K
7200 min Summer	8.537	0.537	0.0	46.1	46.1	4384.1	O K
8640 min Summer	8.496	0.496	0.0	46.1	46.1	4053.3	O K
10080 min Summer	8.464	0.464	0.0	46.1	46.1	3788.3	O K
15 min Winter	8.368	0.368	0.0	45.8	45.8	3008.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	121.903	0.0	1976.0	26
30 min Summer	80.162	0.0	2661.5	41
60 min Summer	50.146	0.0	3973.9	70
120 min Summer	30.797	0.0	4894.6	130
180 min Summer	23.054	0.0	5473.7	190
240 min Summer	18.681	0.0	5873.1	248
360 min Summer	13.737	0.0	6365.6	368
480 min Summer	10.934	0.0	6628.1	486
600 min Summer	9.112	0.0	6763.8	604
720 min Summer	7.828	0.0	6817.3	724
960 min Summer	6.126	0.0	6757.3	962
1440 min Summer	4.308	0.0	6338.3	1246
2160 min Summer	3.022	0.0	9246.5	1608
2880 min Summer	2.358	0.0	9564.6	1968
4320 min Summer	1.682	0.0	10020.3	2768
5760 min Summer	1.338	0.0	11286.3	3536
7200 min Summer	1.134	0.0	11927.5	4328
8640 min Summer	0.999	0.0	12551.8	5096
10080 min Summer	0.903	0.0	13130.9	5848
15 min Winter	121.903	0.0	2245.7	26

Summary of Results for 100 year Return Period (+25%)

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
30 min Winter	8.483	0.483	0.0	46.1	46.1	3942.4	O K
60 min Winter	8.599	0.599	0.0	46.1	46.1	4897.4	O K
120 min Winter	8.727	0.727	0.0	46.1	46.1	5939.5	O K
180 min Winter	8.807	0.807	0.0	46.1	46.1	6594.3	O K
240 min Winter	8.862	0.862	0.0	46.1	46.1	7042.1	O K
360 min Winter	8.929	0.929	0.0	46.1	46.1	7586.3	O K
480 min Winter	8.962	0.962	0.0	46.1	46.1	7862.7	O K
600 min Winter	8.979	0.979	0.0	46.1	46.1	7999.5	O K
720 min Winter	8.986	0.986	0.0	46.1	46.1	8054.1	O K
960 min Winter	8.981	0.981	0.0	46.1	46.1	8017.1	O K
1440 min Winter	8.943	0.943	0.0	46.1	46.1	7700.3	O K
2160 min Winter	8.875	0.875	0.0	46.1	46.1	7148.7	O K
2880 min Winter	8.816	0.816	0.0	46.1	46.1	6670.7	O K
4320 min Winter	8.700	0.700	0.0	46.1	46.1	5716.3	O K
5760 min Winter	8.600	0.600	0.0	46.1	46.1	4898.3	O K
7200 min Winter	8.520	0.520	0.0	46.1	46.1	4248.5	O K
8640 min Winter	8.456	0.456	0.0	46.1	46.1	3727.0	O K
10080 min Winter	8.406	0.406	0.0	46.0	46.0	3315.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	80.162	0.0	2978.2	41
60 min Winter	50.146	0.0	4465.9	70
120 min Winter	30.797	0.0	5469.3	128
180 min Winter	23.054	0.0	6077.1	186
240 min Winter	18.681	0.0	6480.7	244
360 min Winter	13.737	0.0	6937.4	362
480 min Winter	10.934	0.0	7119.5	478
600 min Winter	9.112	0.0	7149.1	592
720 min Winter	7.828	0.0	7088.7	708
960 min Winter	6.126	0.0	6902.0	932
1440 min Winter	4.308	0.0	6491.3	1360
2160 min Winter	3.022	0.0	10336.2	1696
2880 min Winter	2.358	0.0	10658.9	2164
4320 min Winter	1.682	0.0	11106.4	3028
5760 min Winter	1.338	0.0	12655.2	3816
7200 min Winter	1.134	0.0	13381.4	4608
8640 min Winter	0.999	0.0	14091.0	5360
10080 min Winter	0.903	0.0	14759.4	6056

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 446317 295054 SP 46317 95054
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+25

Time Area Diagram

Total Area (ha) 11.900

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	3.960	4	8	3.970	8	12	3.970

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 8.000 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	8600.0	0.0	1.100	0.0	0.0
1.000	8600.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0284-4610-1000-4610
Design Head (m)	1.000
Design Flow (l/s)	46.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	284
Invert Level (m)	8.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	46.1
Flush-Flo™	0.435	46.1
Kick-Flo®	0.777	40.8
Mean Flow over Head Range	-	37.2

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	8.9	1.200	50.3	3.000	78.4	7.000	118.5
0.200	29.3	1.400	54.2	3.500	84.5	7.500	122.6
0.300	44.8	1.600	57.8	4.000	90.2	8.000	126.5
0.400	46.0	1.800	61.2	4.500	95.5	8.500	130.3
0.500	45.9	2.000	64.4	5.000	100.6	9.000	134.0
0.600	45.0	2.200	67.5	5.500	105.3	9.500	137.6
0.800	41.4	2.400	70.4	6.000	109.9		
1.000	46.1	2.600	73.2	6.500	114.3		

Summary of Results for 100 year Return Period (+25%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.285	0.285	2.8	130.6	O K
30 min Summer	9.363	0.363	2.8	170.6	O K
60 min Summer	9.438	0.438	2.8	210.8	O K
120 min Summer	9.514	0.514	2.8	253.6	O K
180 min Summer	9.557	0.557	2.8	278.9	O K
240 min Summer	9.585	0.585	2.8	295.3	O K
360 min Summer	9.614	0.614	2.8	313.0	O K
480 min Summer	9.624	0.624	2.8	319.2	O K
600 min Summer	9.624	0.624	2.8	319.6	O K
720 min Summer	9.620	0.620	2.8	316.6	O K
960 min Summer	9.601	0.601	2.8	305.2	O K
1440 min Summer	9.563	0.563	2.8	282.4	O K
2160 min Summer	9.513	0.513	2.8	253.0	O K
2880 min Summer	9.468	0.468	2.8	227.5	O K
4320 min Summer	9.387	0.387	2.8	183.1	O K
5760 min Summer	9.325	0.325	2.8	150.7	O K
7200 min Summer	9.277	0.277	2.8	126.4	O K
8640 min Summer	9.239	0.239	2.8	107.7	O K
10080 min Summer	9.210	0.210	2.8	93.6	O K
15 min Winter	9.317	0.317	2.8	146.4	O K
30 min Winter	9.402	0.402	2.8	191.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	121.903	0.0	126.3	19
30 min Summer	80.162	0.0	165.6	34
60 min Summer	50.146	0.0	215.0	64
120 min Summer	30.797	0.0	264.0	124
180 min Summer	23.054	0.0	296.1	182
240 min Summer	18.681	0.0	319.6	242
360 min Summer	13.737	0.0	351.5	362
480 min Summer	10.934	0.0	371.8	482
600 min Summer	9.112	0.0	385.8	600
720 min Summer	7.828	0.0	395.8	720
960 min Summer	6.126	0.0	407.3	896
1440 min Summer	4.308	0.0	402.9	1124
2160 min Summer	3.022	0.0	471.1	1512
2880 min Summer	2.358	0.0	489.8	1932
4320 min Summer	1.682	0.0	523.2	2680
5760 min Summer	1.338	0.0	558.0	3456
7200 min Summer	1.134	0.0	590.7	4176
8640 min Summer	0.999	0.0	623.8	4848
10080 min Summer	0.903	0.0	657.1	5552
15 min Winter	121.903	0.0	141.5	19
30 min Winter	80.162	0.0	184.4	33

Summary of Results for 100 year Return Period (+25%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	9.485	0.485	2.8	237.0	O K
120 min Winter	9.568	0.568	2.8	285.3	O K
180 min Winter	9.616	0.616	2.8	314.4	O K
240 min Winter	9.647	0.647	2.8	333.4	O K
360 min Winter	9.681	0.681	2.8	354.7	O K
480 min Winter	9.694	0.694	2.8	363.3	O K
600 min Winter	9.697	0.697	2.8	365.3	O K
720 min Winter	9.694	0.694	2.8	363.4	O K
960 min Winter	9.678	0.678	2.8	353.3	O K
1440 min Winter	9.633	0.633	2.8	324.7	O K
2160 min Winter	9.572	0.572	2.8	288.1	O K
2880 min Winter	9.515	0.515	2.8	254.3	O K
4320 min Winter	9.397	0.397	2.8	188.4	O K
5760 min Winter	9.301	0.301	2.8	138.4	O K
7200 min Winter	9.229	0.229	2.8	102.7	O K
8640 min Winter	9.177	0.177	2.8	77.9	O K
10080 min Winter	9.142	0.142	2.7	61.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	50.146	0.0	240.8	62
120 min Winter	30.797	0.0	295.4	122
180 min Winter	23.054	0.0	331.1	180
240 min Winter	18.681	0.0	357.0	238
360 min Winter	13.737	0.0	391.4	356
480 min Winter	10.934	0.0	412.1	472
600 min Winter	9.112	0.0	424.6	584
720 min Winter	7.828	0.0	430.9	698
960 min Winter	6.126	0.0	429.0	914
1440 min Winter	4.308	0.0	410.3	1182
2160 min Winter	3.022	0.0	527.6	1624
2880 min Winter	2.358	0.0	548.5	2080
4320 min Winter	1.682	0.0	585.9	2896
5760 min Winter	1.338	0.0	625.1	3632
7200 min Winter	1.134	0.0	661.8	4328
8640 min Winter	0.999	0.0	698.9	5008
10080 min Winter	0.903	0.0	736.5	5640

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 446317 295054 SP 46317 95054
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+25

Time Area Diagram

Total Area (ha) 0.580

Time (mins) From:	To:	Area (ha)
0	4	0.580

Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 9.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	415.0	0.300	506.2	0.600	606.4	0.900	715.7
0.100	444.4	0.400	538.6	0.700	641.8	1.000	754.1
0.200	474.8	0.500	572.0	0.800	678.3		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0084-2800-0700-2800
Design Head (m)	0.700
Design Flow (l/s)	2.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	84
Invert Level (m)	9.000
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	2.8
Flush-Flo™	0.210	2.8
Kick-Flo®	0.462	2.3
Mean Flow over Head Range	-	2.4

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	2.5	1.200	3.6	3.000	5.5	7.000	8.2
0.200	2.8	1.400	3.8	3.500	5.9	7.500	8.5
0.300	2.7	1.600	4.1	4.000	6.3	8.000	8.7
0.400	2.6	1.800	4.3	4.500	6.6	8.500	9.0
0.500	2.4	2.000	4.5	5.000	7.0	9.000	9.3
0.600	2.6	2.200	4.7	5.500	7.3	9.500	9.5
0.800	3.0	2.400	4.9	6.000	7.6		
1.000	3.3	2.600	5.1	6.500	7.9		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.317	0.317	2.8	146.4	O K
30 min Summer	9.402	0.402	2.8	191.5	O K
60 min Summer	9.485	0.485	2.8	237.1	O K
120 min Summer	9.568	0.568	2.8	285.2	O K
180 min Summer	9.615	0.615	2.8	314.1	O K
240 min Summer	9.646	0.646	2.8	333.0	O K
360 min Summer	9.680	0.680	2.8	353.9	O K
480 min Summer	9.692	0.692	2.8	362.0	O K
600 min Summer	9.695	0.695	2.8	363.5	O K
720 min Summer	9.691	0.691	2.8	361.2	O K
960 min Summer	9.673	0.673	2.8	349.9	O K
1440 min Summer	9.634	0.634	2.8	325.3	O K
2160 min Summer	9.583	0.583	2.8	294.3	O K
2880 min Summer	9.540	0.540	2.8	269.1	O K
4320 min Summer	9.468	0.468	2.8	227.6	O K
5760 min Summer	9.399	0.399	2.8	189.7	O K
7200 min Summer	9.347	0.347	2.8	162.1	O K
8640 min Summer	9.305	0.305	2.8	140.5	O K
10080 min Summer	9.271	0.271	2.8	123.4	O K
15 min Winter	9.351	0.351	2.8	164.2	O K
30 min Winter	9.445	0.445	2.8	214.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	136.531	0.0	141.5	19
30 min Summer	89.782	0.0	184.4	34
60 min Summer	56.163	0.0	240.8	64
120 min Summer	34.492	0.0	295.4	124
180 min Summer	25.821	0.0	331.1	182
240 min Summer	20.923	0.0	357.0	242
360 min Summer	15.386	0.0	391.5	362
480 min Summer	12.246	0.0	412.2	482
600 min Summer	10.205	0.0	424.7	602
720 min Summer	8.767	0.0	431.0	720
960 min Summer	6.861	0.0	429.1	934
1440 min Summer	4.825	0.0	409.4	1152
2160 min Summer	3.385	0.0	527.5	1536
2880 min Summer	2.641	0.0	548.4	1956
4320 min Summer	1.884	0.0	585.1	2768
5760 min Summer	1.499	0.0	625.0	3520
7200 min Summer	1.270	0.0	661.7	4256
8640 min Summer	1.118	0.0	698.8	5008
10080 min Summer	1.012	0.0	736.2	5744
15 min Winter	136.531	0.0	158.2	19
30 min Winter	89.782	0.0	203.8	33

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	9.535	0.535	2.8	266.1	O K
120 min Winter	9.627	0.627	2.8	320.8	O K
180 min Winter	9.679	0.679	2.8	353.9	O K
240 min Winter	9.714	0.714	2.8	375.9	Flood Risk
360 min Winter	9.752	0.752	2.9	401.0	Flood Risk
480 min Winter	9.768	0.768	2.9	411.8	Flood Risk
600 min Winter	9.773	0.773	2.9	415.2	Flood Risk
720 min Winter	9.772	0.772	2.9	414.2	Flood Risk
960 min Winter	9.758	0.758	2.9	404.9	Flood Risk
1440 min Winter	9.713	0.713	2.8	375.4	Flood Risk
2160 min Winter	9.653	0.653	2.8	337.1	O K
2880 min Winter	9.598	0.598	2.8	303.2	O K
4320 min Winter	9.498	0.498	2.8	244.4	O K
5760 min Winter	9.391	0.391	2.8	185.3	O K
7200 min Winter	9.309	0.309	2.8	142.4	O K
8640 min Winter	9.244	0.244	2.8	110.3	O K
10080 min Winter	9.196	0.196	2.8	87.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	56.163	0.0	269.6	64
120 min Winter	34.492	0.0	330.4	122
180 min Winter	25.821	0.0	369.7	180
240 min Winter	20.923	0.0	397.5	240
360 min Winter	15.386	0.0	431.7	356
480 min Winter	12.246	0.0	445.6	472
600 min Winter	10.205	0.0	446.3	586
720 min Winter	8.767	0.0	443.4	700
960 min Winter	6.861	0.0	435.8	922
1440 min Winter	4.825	0.0	418.2	1312
2160 min Winter	3.385	0.0	590.7	1644
2880 min Winter	2.641	0.0	614.0	2104
4320 min Winter	1.884	0.0	654.1	3024
5760 min Winter	1.499	0.0	700.1	3800
7200 min Winter	1.270	0.0	741.3	4472
8640 min Winter	1.118	0.0	783.0	5184
10080 min Winter	1.012	0.0	825.1	5848

Summary of Results for 100 year Return Period (+25%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.262	0.262	2.8	187.3	O K
30 min Summer	9.336	0.336	2.8	245.4	O K
60 min Summer	9.410	0.410	2.8	304.6	O K
120 min Summer	9.486	0.486	2.8	369.0	O K
180 min Summer	9.532	0.532	2.8	408.9	O K
240 min Summer	9.563	0.563	2.8	435.9	O K
360 min Summer	9.599	0.599	2.8	468.2	O K
480 min Summer	9.616	0.616	2.8	484.0	O K
600 min Summer	9.624	0.624	2.8	491.2	O K
720 min Summer	9.627	0.627	2.8	493.2	O K
960 min Summer	9.621	0.621	2.8	488.3	O K
1440 min Summer	9.594	0.594	2.8	463.6	O K
2160 min Summer	9.555	0.555	2.8	428.5	O K
2880 min Summer	9.522	0.522	2.8	400.2	O K
4320 min Summer	9.470	0.470	2.8	354.8	O K
5760 min Summer	9.421	0.421	2.8	314.5	O K
7200 min Summer	9.385	0.385	2.8	284.5	O K
8640 min Summer	9.356	0.356	2.8	260.7	O K
10080 min Summer	9.331	0.331	2.8	241.4	O K
15 min Winter	9.291	0.291	2.8	210.0	O K
30 min Winter	9.374	0.374	2.8	275.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	121.903	0.0	170.3	23
30 min Summer	80.162	0.0	215.5	38
60 min Summer	50.146	0.0	301.7	68
120 min Summer	30.797	0.0	367.3	126
180 min Summer	23.054	0.0	406.2	186
240 min Summer	18.681	0.0	428.5	246
360 min Summer	13.737	0.0	438.4	366
480 min Summer	10.934	0.0	434.2	484
600 min Summer	9.112	0.0	429.5	604
720 min Summer	7.828	0.0	424.7	724
960 min Summer	6.126	0.0	415.3	962
1440 min Summer	4.308	0.0	396.4	1370
2160 min Summer	3.022	0.0	667.0	1692
2880 min Summer	2.358	0.0	690.7	2076
4320 min Summer	1.682	0.0	718.0	2900
5760 min Summer	1.338	0.0	797.1	3680
7200 min Summer	1.134	0.0	843.9	4464
8640 min Summer	0.999	0.0	890.8	5192
10080 min Summer	0.903	0.0	937.3	5952
15 min Winter	121.903	0.0	189.2	23
30 min Winter	80.162	0.0	229.7	37

Summary of Results for 100 year Return Period (+25%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	9.454	0.454	2.8	342.1	O K
120 min Winter	9.539	0.539	2.8	414.7	O K
180 min Winter	9.590	0.590	2.8	459.9	O K
240 min Winter	9.624	0.624	2.8	490.8	O K
360 min Winter	9.665	0.665	2.8	528.5	O K
480 min Winter	9.685	0.685	2.8	547.6	O K
600 min Winter	9.695	0.695	2.8	557.1	O K
720 min Winter	9.699	0.699	2.8	560.9	O K
960 min Winter	9.697	0.697	2.8	558.3	O K
1440 min Winter	9.673	0.673	2.8	536.1	O K
2160 min Winter	9.625	0.625	2.8	492.2	O K
2880 min Winter	9.587	0.587	2.8	457.5	O K
4320 min Winter	9.519	0.519	2.8	397.1	O K
5760 min Winter	9.452	0.452	2.8	339.9	O K
7200 min Winter	9.390	0.390	2.8	288.6	O K
8640 min Winter	9.340	0.340	2.8	248.6	O K
10080 min Winter	9.299	0.299	2.8	216.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	50.146	0.0	336.9	66
120 min Winter	30.797	0.0	405.8	126
180 min Winter	23.054	0.0	437.7	184
240 min Winter	18.681	0.0	443.1	242
360 min Winter	13.737	0.0	439.1	360
480 min Winter	10.934	0.0	435.0	476
600 min Winter	9.112	0.0	431.3	592
720 min Winter	7.828	0.0	427.8	708
960 min Winter	6.126	0.0	420.8	936
1440 min Winter	4.308	0.0	406.6	1374
2160 min Winter	3.022	0.0	744.1	1776
2880 min Winter	2.358	0.0	766.9	2216
4320 min Winter	1.682	0.0	750.5	3152
5760 min Winter	1.338	0.0	892.9	4032
7200 min Winter	1.134	0.0	945.4	4824
8640 min Winter	0.999	0.0	998.3	5536
10080 min Winter	0.903	0.0	1051.0	6352

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 446317 295054 SP 46317 95054
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+25

Time Area Diagram

Total Area (ha) 0.830

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.415	4	8	0.415

Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 9.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	666.0	0.300	780.3	0.600	903.7	0.900	1036.1
0.100	703.1	0.400	820.4	0.700	946.8	1.000	1082.2
0.200	741.2	0.500	861.5	0.800	990.9		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0084-2800-0700-2800
Design Head (m)	0.700
Design Flow (l/s)	2.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	84
Invert Level (m)	9.000
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	2.8
Flush-Flo™	0.210	2.8
Kick-Flo®	0.462	2.3
Mean Flow over Head Range	-	2.4

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	2.5	1.200	3.6	3.000	5.5	7.000	8.2
0.200	2.8	1.400	3.8	3.500	5.9	7.500	8.5
0.300	2.7	1.600	4.1	4.000	6.3	8.000	8.7
0.400	2.6	1.800	4.3	4.500	6.6	8.500	9.0
0.500	2.4	2.000	4.5	5.000	7.0	9.000	9.3
0.600	2.6	2.200	4.7	5.500	7.3	9.500	9.5
0.800	3.0	2.400	4.9	6.000	7.6		
1.000	3.3	2.600	5.1	6.500	7.9		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.291	0.291	2.8	210.0	O K
30 min Summer	9.374	0.374	2.8	275.3	O K
60 min Summer	9.455	0.455	2.8	342.1	O K
120 min Summer	9.539	0.539	2.8	414.7	O K
180 min Summer	9.590	0.590	2.8	459.7	O K
240 min Summer	9.623	0.623	2.8	490.4	O K
360 min Summer	9.664	0.664	2.8	527.8	O K
480 min Summer	9.684	0.684	2.8	546.6	O K
600 min Summer	9.694	0.694	2.8	555.7	O K
720 min Summer	9.697	0.697	2.8	559.1	O K
960 min Summer	9.694	0.694	2.8	555.6	O K
1440 min Summer	9.668	0.668	2.8	531.3	O K
2160 min Summer	9.627	0.627	2.8	493.3	O K
2880 min Summer	9.594	0.594	2.8	463.4	O K
4320 min Summer	9.543	0.543	2.8	418.7	O K
5760 min Summer	9.503	0.503	2.8	383.7	O K
7200 min Summer	9.470	0.470	2.8	355.4	O K
8640 min Summer	9.438	0.438	2.8	328.4	O K
10080 min Summer	9.413	0.413	2.8	307.1	O K
15 min Winter	9.324	0.324	2.8	235.5	O K
30 min Winter	9.415	0.415	2.8	308.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	136.531	0.0	189.2	23
30 min Summer	89.782	0.0	229.6	38
60 min Summer	56.163	0.0	336.9	68
120 min Summer	34.492	0.0	405.8	126
180 min Summer	25.821	0.0	437.6	186
240 min Summer	20.923	0.0	443.0	246
360 min Summer	15.386	0.0	439.1	366
480 min Summer	12.246	0.0	435.1	484
600 min Summer	10.205	0.0	431.5	604
720 min Summer	8.767	0.0	428.1	724
960 min Summer	6.861	0.0	421.1	962
1440 min Summer	4.825	0.0	406.5	1426
2160 min Summer	3.385	0.0	743.9	1732
2880 min Summer	2.641	0.0	766.1	2108
4320 min Summer	1.884	0.0	737.5	2940
5760 min Summer	1.499	0.0	892.8	3752
7200 min Summer	1.270	0.0	945.1	4608
8640 min Summer	1.118	0.0	998.0	5368
10080 min Summer	1.012	0.0	1050.4	6152
15 min Winter	136.531	0.0	208.3	23
30 min Winter	89.782	0.0	233.4	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	9.504	0.504	2.8	384.0	O K
120 min Winter	9.596	0.596	2.8	465.8	O K
180 min Winter	9.652	0.652	2.8	516.9	O K
240 min Winter	9.690	0.690	2.8	552.1	O K
360 min Winter	9.736	0.736	2.9	595.6	Flood Risk
480 min Winter	9.759	0.759	2.9	618.2	Flood Risk
600 min Winter	9.771	0.771	2.9	630.1	Flood Risk
720 min Winter	9.777	0.777	2.9	635.5	Flood Risk
960 min Winter	9.776	0.776	2.9	634.8	Flood Risk
1440 min Winter	9.755	0.755	2.9	614.0	Flood Risk
2160 min Winter	9.708	0.708	2.8	568.9	Flood Risk
2880 min Winter	9.669	0.669	2.8	532.1	O K
4320 min Winter	9.603	0.603	2.8	472.2	O K
5760 min Winter	9.547	0.547	2.8	421.4	O K
7200 min Winter	9.497	0.497	2.8	377.8	O K
8640 min Winter	9.444	0.444	2.8	333.1	O K
10080 min Winter	9.397	0.397	2.8	294.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	56.163	0.0	374.7	66
120 min Winter	34.492	0.0	438.4	126
180 min Winter	25.821	0.0	445.6	184
240 min Winter	20.923	0.0	443.8	242
360 min Winter	15.386	0.0	441.2	360
480 min Winter	12.246	0.0	439.7	476
600 min Winter	10.205	0.0	438.3	594
720 min Winter	8.767	0.0	436.9	710
960 min Winter	6.861	0.0	433.9	938
1440 min Winter	4.825	0.0	426.7	1384
2160 min Winter	3.385	0.0	823.8	1976
2880 min Winter	2.641	0.0	829.1	2228
4320 min Winter	1.884	0.0	764.5	3160
5760 min Winter	1.499	0.0	999.9	4088
7200 min Winter	1.270	0.0	1058.4	4976
8640 min Winter	1.118	0.0	1117.8	5800
10080 min Winter	1.012	0.0	1177.5	6560

Summary of Results for 100 year Return Period (+25%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.051	0.551	2.7	146.4	O K
30 min Summer	9.180	0.680	2.7	191.5	O K
60 min Summer	9.298	0.798	2.7	236.9	O K
120 min Summer	9.413	0.913	2.7	284.6	O K
180 min Summer	9.478	0.978	2.7	313.2	O K
240 min Summer	9.519	1.019	2.7	332.0	O K
360 min Summer	9.563	1.063	2.7	352.7	O K
480 min Summer	9.579	1.079	2.7	360.6	O K
600 min Summer	9.582	1.082	2.7	361.9	O K
720 min Summer	9.577	1.077	2.7	359.3	O K
960 min Summer	9.552	1.052	2.7	347.5	O K
1440 min Summer	9.494	0.994	2.7	320.5	O K
2160 min Summer	9.422	0.922	2.7	288.3	O K
2880 min Summer	9.364	0.864	2.7	263.6	O K
4320 min Summer	9.269	0.769	2.7	225.2	O K
5760 min Summer	9.181	0.681	2.7	191.8	O K
7200 min Summer	9.094	0.594	2.7	161.1	O K
8640 min Summer	9.026	0.526	2.7	138.2	O K
10080 min Summer	8.971	0.471	2.7	120.7	O K
15 min Winter	9.103	0.603	2.7	164.2	O K
30 min Winter	9.242	0.742	2.7	215.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	121.903	0.0	146.1	19
30 min Summer	80.162	0.0	190.2	34
60 min Summer	50.146	0.0	243.4	64
120 min Summer	30.797	0.0	298.7	124
180 min Summer	23.054	0.0	335.1	182
240 min Summer	18.681	0.0	361.5	242
360 min Summer	13.737	0.0	396.6	362
480 min Summer	10.934	0.0	415.5	482
600 min Summer	9.112	0.0	420.7	602
720 min Summer	7.828	0.0	419.7	720
960 min Summer	6.126	0.0	413.9	960
1440 min Summer	4.308	0.0	397.6	1180
2160 min Summer	3.022	0.0	529.7	1556
2880 min Summer	2.358	0.0	550.9	1960
4320 min Summer	1.682	0.0	588.7	2768
5760 min Summer	1.338	0.0	626.1	3632
7200 min Summer	1.134	0.0	663.0	4328
8640 min Summer	0.999	0.0	700.5	5024
10080 min Summer	0.903	0.0	738.8	5752
15 min Winter	121.903	0.0	163.4	19
30 min Winter	80.162	0.0	207.6	33

Summary of Results for 100 year Return Period (+25%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	9.369	0.869	2.7	266.0	O K
120 min Winter	9.494	0.994	2.7	320.5	O K
180 min Winter	9.565	1.065	2.7	353.6	O K
240 min Winter	9.610	1.110	2.7	375.5	O K
360 min Winter	9.660	1.160	2.8	400.7	O K
480 min Winter	9.681	1.181	2.8	411.5	O K
600 min Winter	9.688	1.188	2.8	414.8	O K
720 min Winter	9.686	1.186	2.8	413.9	O K
960 min Winter	9.668	1.168	2.8	404.4	O K
1440 min Winter	9.607	1.107	2.7	374.2	O K
2160 min Winter	9.523	1.023	2.7	333.7	O K
2880 min Winter	9.449	0.949	2.7	300.4	O K
4320 min Winter	9.319	0.819	2.7	245.1	O K
5760 min Winter	9.187	0.687	2.7	194.3	O K
7200 min Winter	9.044	0.544	2.7	144.4	O K
8640 min Winter	8.938	0.438	2.7	110.5	O K
10080 min Winter	8.854	0.354	2.7	85.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	50.146	0.0	272.5	64
120 min Winter	30.797	0.0	334.3	122
180 min Winter	23.054	0.0	374.4	180
240 min Winter	18.681	0.0	402.4	240
360 min Winter	13.737	0.0	427.1	356
480 min Winter	10.934	0.0	428.0	472
600 min Winter	9.112	0.0	426.1	588
720 min Winter	7.828	0.0	423.5	700
960 min Winter	6.126	0.0	417.9	924
1440 min Winter	4.308	0.0	405.4	1338
2160 min Winter	3.022	0.0	593.2	1660
2880 min Winter	2.358	0.0	616.9	2108
4320 min Winter	1.682	0.0	658.5	3024
5760 min Winter	1.338	0.0	701.3	3920
7200 min Winter	1.134	0.0	742.6	4608
8640 min Winter	0.999	0.0	784.7	5272
10080 min Winter	0.903	0.0	827.6	5944

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 446317 295054 SP 46317 95054
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+25

Time Area Diagram

Total Area (ha) 0.650

Time (mins) From:	To:	Area (ha)
0	4	0.650

Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 8.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	205.0	0.400	294.3	0.800	399.6	1.200	521.0
0.100	225.8	0.500	319.1	0.900	428.4	1.300	553.9
0.200	247.6	0.600	344.9	1.000	458.3	1.400	587.8
0.300	270.4	0.700	371.7	1.100	489.1	1.500	622.6

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0077-2800-1200-2800
Design Head (m)	1.200
Design Flow (l/s)	2.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	77
Invert Level (m)	8.500
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	2.8
Flush-Flo™	0.336	2.7
Kick-Flo®	0.683	2.2
Mean Flow over Head Range	-	2.4

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	2.1	1.200	2.8	3.000	4.3	7.000	6.4
0.200	2.6	1.400	3.0	3.500	4.6	7.500	6.6
0.300	2.7	1.600	3.2	4.000	4.9	8.000	6.8
0.400	2.7	1.800	3.4	4.500	5.2	8.500	7.0
0.500	2.6	2.000	3.5	5.000	5.4	9.000	7.2
0.600	2.4	2.200	3.7	5.500	5.7	9.500	7.3
0.800	2.3	2.400	3.8	6.000	5.9		
1.000	2.6	2.600	4.0	6.500	6.1		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.103	0.603	2.7	164.3	O K
30 min Summer	9.242	0.742	2.7	215.0	O K
60 min Summer	9.369	0.869	2.7	266.0	O K
120 min Summer	9.493	0.993	2.7	320.1	O K
180 min Summer	9.563	1.063	2.7	352.9	O K
240 min Summer	9.608	1.108	2.7	374.6	O K
360 min Summer	9.657	1.157	2.7	399.3	O K
480 min Summer	9.678	1.178	2.8	409.5	O K
600 min Summer	9.683	1.183	2.8	412.3	O K
720 min Summer	9.680	1.180	2.8	410.7	O K
960 min Summer	9.659	1.159	2.7	399.9	O K
1440 min Summer	9.600	1.100	2.7	370.8	O K
2160 min Summer	9.527	1.027	2.7	335.6	O K
2880 min Summer	9.469	0.969	2.7	309.2	O K
4320 min Summer	9.379	0.879	2.7	270.0	O K
5760 min Summer	9.305	0.805	2.7	239.5	O K
7200 min Summer	9.241	0.741	2.7	214.4	O K
8640 min Summer	9.176	0.676	2.7	190.1	O K
10080 min Summer	9.111	0.611	2.7	166.9	O K
15 min Winter	9.160	0.660	2.7	184.2	O K
30 min Winter	9.309	0.809	2.7	241.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	136.531	0.0	163.4	19
30 min Summer	89.782	0.0	207.6	34
60 min Summer	56.163	0.0	272.5	64
120 min Summer	34.492	0.0	334.3	124
180 min Summer	25.821	0.0	374.4	184
240 min Summer	20.923	0.0	402.5	242
360 min Summer	15.386	0.0	427.7	362
480 min Summer	12.246	0.0	428.9	482
600 min Summer	10.205	0.0	427.3	602
720 min Summer	8.767	0.0	424.9	722
960 min Summer	6.861	0.0	419.4	960
1440 min Summer	4.825	0.0	406.6	1214
2160 min Summer	3.385	0.0	593.2	1580
2880 min Summer	2.641	0.0	616.9	1988
4320 min Summer	1.884	0.0	658.0	2808
5760 min Summer	1.499	0.0	701.2	3632
7200 min Summer	1.270	0.0	742.6	4464
8640 min Summer	1.118	0.0	784.6	5272
10080 min Summer	1.012	0.0	827.5	5952
15 min Winter	136.531	0.0	182.2	19
30 min Winter	89.782	0.0	212.1	34

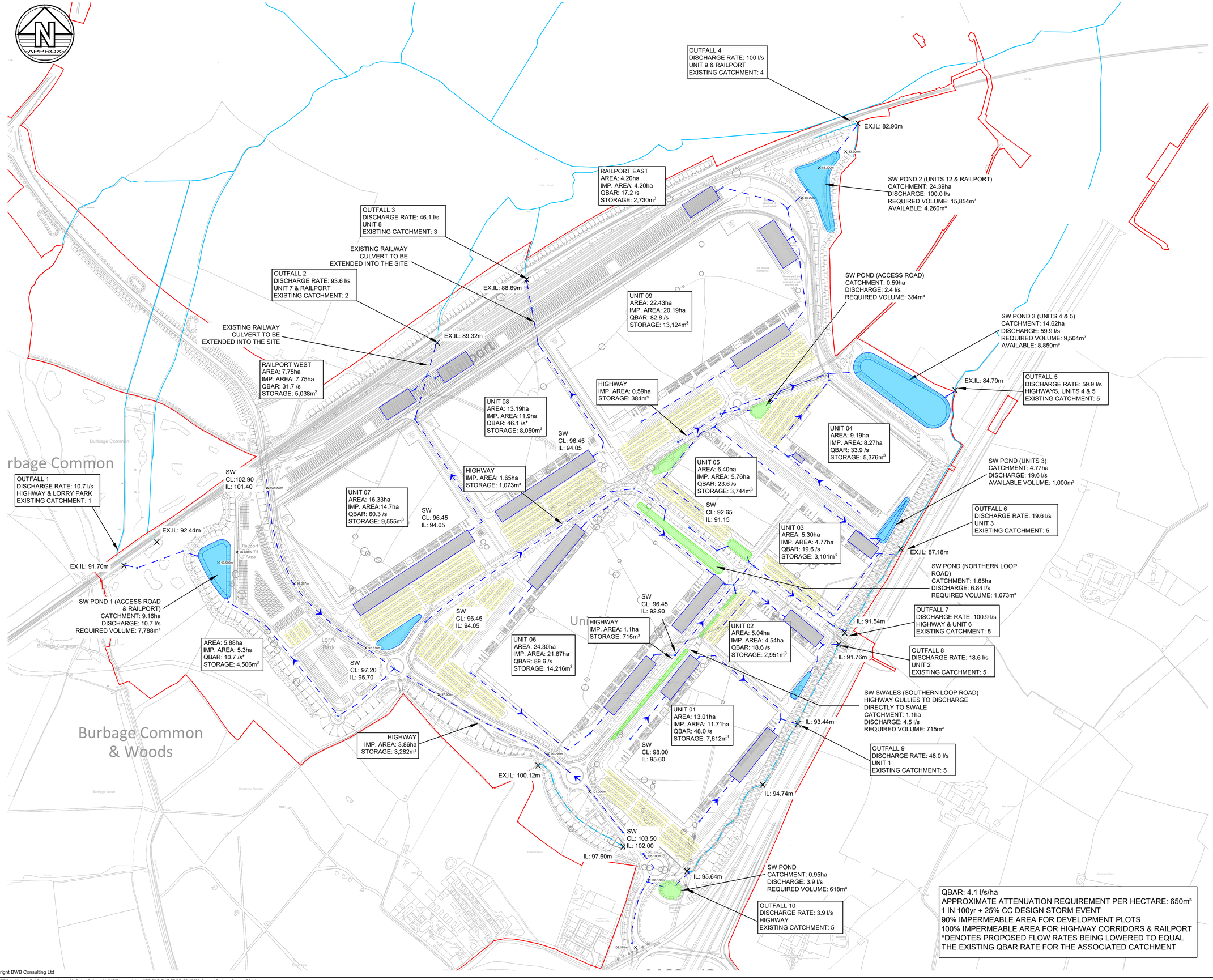
Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	9.445	0.945	2.7	298.6	O K
120 min Winter	9.579	1.079	2.7	360.4	O K
180 min Winter	9.655	1.155	2.7	398.1	O K
240 min Winter	9.705	1.205	2.8	423.5	Flood Risk
360 min Winter	9.760	1.260	2.9	453.2	Flood Risk
480 min Winter	9.785	1.285	2.9	466.7	Flood Risk
600 min Winter	9.795	1.295	2.9	471.9	Flood Risk
720 min Winter	9.795	1.295	2.9	472.1	Flood Risk
960 min Winter	9.780	1.280	2.9	464.0	Flood Risk
1440 min Winter	9.725	1.225	2.8	434.2	Flood Risk
2160 min Winter	9.639	1.139	2.7	390.2	O K
2880 min Winter	9.569	1.069	2.7	355.4	O K
4320 min Winter	9.447	0.947	2.7	299.3	O K
5760 min Winter	9.338	0.838	2.7	252.8	O K
7200 min Winter	9.235	0.735	2.7	212.1	O K
8640 min Winter	9.108	0.608	2.7	165.9	O K
10080 min Winter	9.006	0.506	2.7	131.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	56.163	0.0	305.1	64
120 min Winter	34.492	0.0	373.5	122
180 min Winter	25.821	0.0	415.3	180
240 min Winter	20.923	0.0	431.5	240
360 min Winter	15.386	0.0	434.0	356
480 min Winter	12.246	0.0	433.3	474
600 min Winter	10.205	0.0	432.2	590
720 min Winter	8.767	0.0	431.1	702
960 min Winter	6.861	0.0	428.4	926
1440 min Winter	4.825	0.0	422.9	1354
2160 min Winter	3.385	0.0	664.2	1684
2880 min Winter	2.641	0.0	690.6	2136
4320 min Winter	1.884	0.0	731.0	3064
5760 min Winter	1.499	0.0	785.4	3928
7200 min Winter	1.270	0.0	831.8	4824
8640 min Winter	1.118	0.0	878.9	5536
10080 min Winter	1.012	0.0	927.0	6160

APPENDICES

Appendix 9: Concept Drainage Strategy Plans



Notes

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3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.
5. Drawing provided for illustrative purposes only. Design subject to further coordination and approvals.
6. Layout based on AJA drawing: 5905-177.
7. Attenuation indicatively sized for the 1 in 100 year storm event plus a 25% allowance for climate change for the estimated impermeable areas. Allowance made for 650m³ storage per 1ha of impermeable area. To be agreed with the LLFA.
8. Equivalent greenfield runoff rates have been estimate to be 4.1 l/s/ha. To be agreed with the LLFA.
9. Foul water connection and site wide pumping requirements to be discussed and agreed with Severn Trent Water.

Legend

- APPLICATION BOUNDARY
- EXISTING WATERCOURSE
- PROPOSED WATERCOURSE DIVERSION
- INDICATIVE SURFACE WATER DRAINAGE RUN
- ABOVE GROUND ATTENUATION FEATURE
- HIGHWAY SWALE/ATTENUATION
- BELOW GROUND ATTENUATION FEATURE
- PERMEABLE PAVING AND SUB-BASE STORAGE

P04	05.09.22	Updated climate change allowance	LR	RJ
P03	14.12.21	Updated DCO boundary	RJ	CD
P02	30.09.21	Updated to latest masterplan	RJ	CD
P01	25.05.21	Preliminary Issue	RJ	CD
Rev	Date	Details of issue / revision	Drw	Rev

Issues & Revisions

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London | 020 7407 3879
Manchester | 0161 233 4260
Nottingham | 0115 924 1100
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Client
TRITAX SYMMETRY

Project Title
HINCKLEY RAIL FREIGHT INTERCHANGE

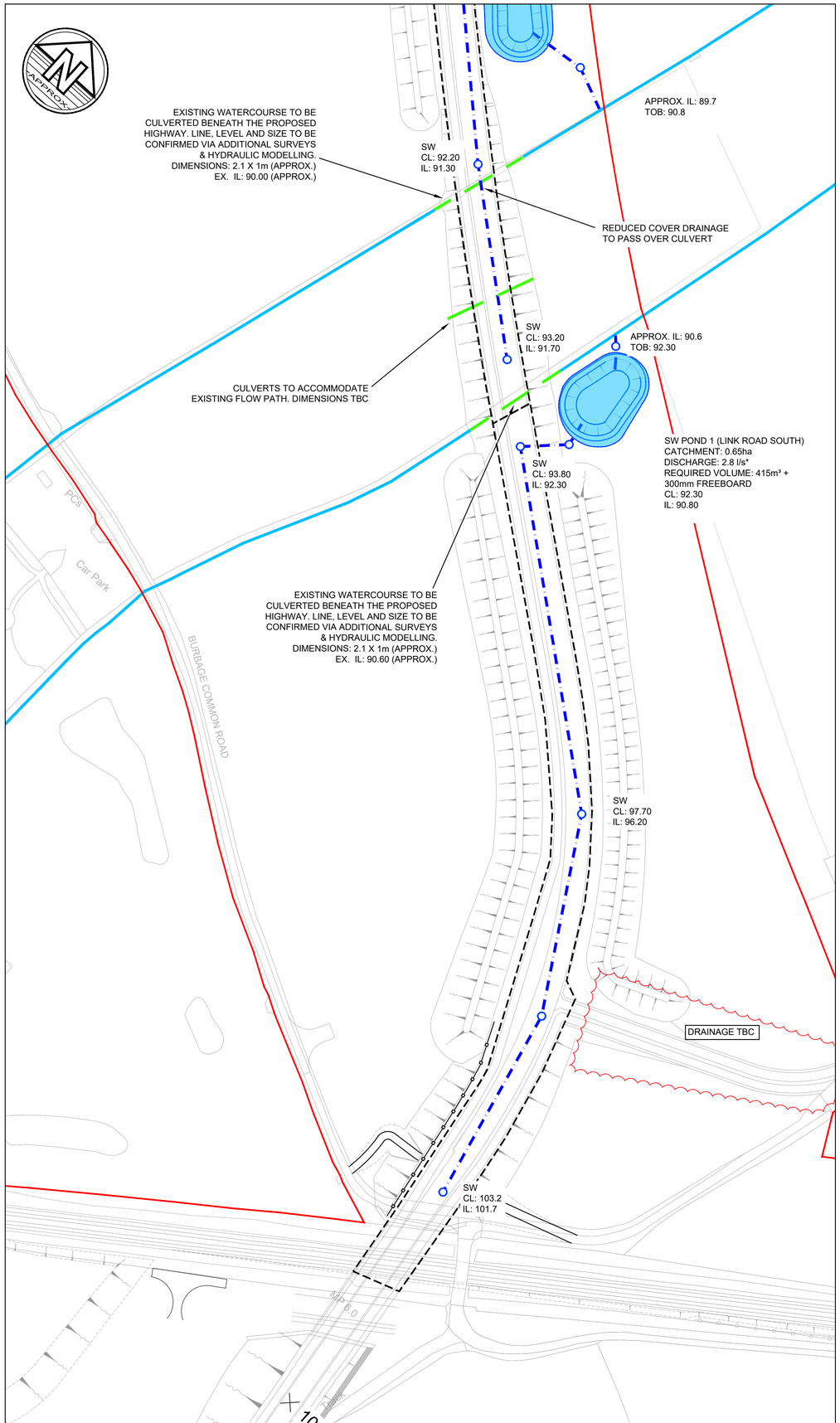
Drawing Title
CONCEPT DRAINAGE STRATEGY PLAN

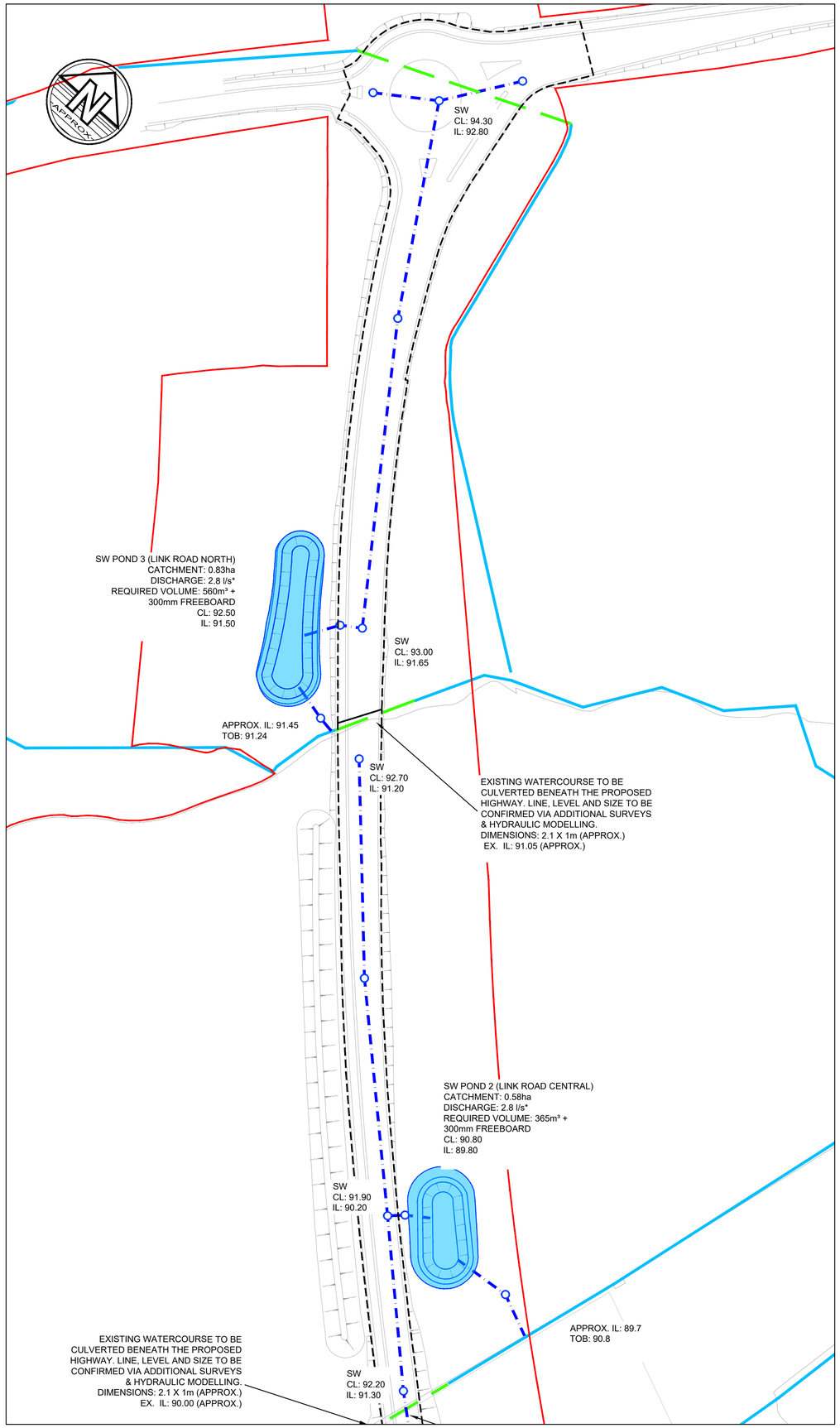
Drawn:	RJ		Reviewed:	CD	
BWB Ref:	NTT 2814	Date:	25.05.21	Scale@A1:	1:4000

Drawing Status
PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
HRF-BWB-EWE-ZZ-DR-CD-00502	S2	P04

X:\NTT\NTT2814_Hinckley Rail Freight Interchange\02. Project Delivery\01. WIP\Drawings\Water\HRF-BWB-EWE-ZZ-DR-CD-00502_Concept Drainage Strategy P04.dwg





Notes

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7. Attenuation indicatively sized for the 1 in 100 year storm event plus a 25% allowance for climate change for the estimated impermeable areas.
8. Equivalent greenfield runoff rates have been estimate to be 4.1 l/s/ha. To be agreed with the LLFA.
9. Foul water connection and site wide pumping requirements to be discussed and agreed with Severn Trent Water.

Legend

- APPLICATION BOUNDARY
- EXISTING WATERCOURSE
- PROPOSED CULVERT
- INDICATIVE SURFACE WATER DRAINAGE RUN
- ABOVE GROUND ATTENUATION FEATURE
- MEASURED IMPERMEABLE AREA

REFER TO BWB WATERCOURSE SURVEY DRAWINGS FOR FURTHER DETAILS OF THE EXISTING CHANNELS. 'HNRFI-BWB-00-00-M2-G-0060' SERIES. FURTHER SURVEYS REQUIRED TO INFORM LEVELS DESIGN. PROPOSED DISCHARGE RATES SPLIT EVENLY BETWEEN THE THREE CATCHMENTS TO AVOID SMALL DISCHARGE RATES.
TOTAL IMPERMEABLE AREA: 2.06ha
GREENFIELD RUNOFF: 4.1 l/s/ha (QBAR)
TOTAL RUNOFF: 8.4 l/s

Rev	Date	Details of issue / revision	Drw	Rev
P03	05.09.22	Updated CC allowances	RJ	CD
P02	14.12.21	Updated to latest highways GA	RJ	CD
P01	22.07.21	Preliminary Issue	RJ	CD

Issues & Revisions

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Manchester | 0161 233 4260
Nottingham | 0115 924 1100
www.bwbconsulting.com

Client
TRITAX SYMMETRY

Project Title
HINCKLEY RAIL FREIGHT INTERCHANGE

Drawing Title
LINK ROAD DRAINAGE STRATEGY PLAN

Drawn:	RJ		Reviewed:	CD	
BWB Ref:	NTT 2814	Date:	22.07.21	Scale@A1:	1:1000

Drawing Status
PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
HRF-BWB-EWE-D1-DR-CD-00501	**S2**	**P03**

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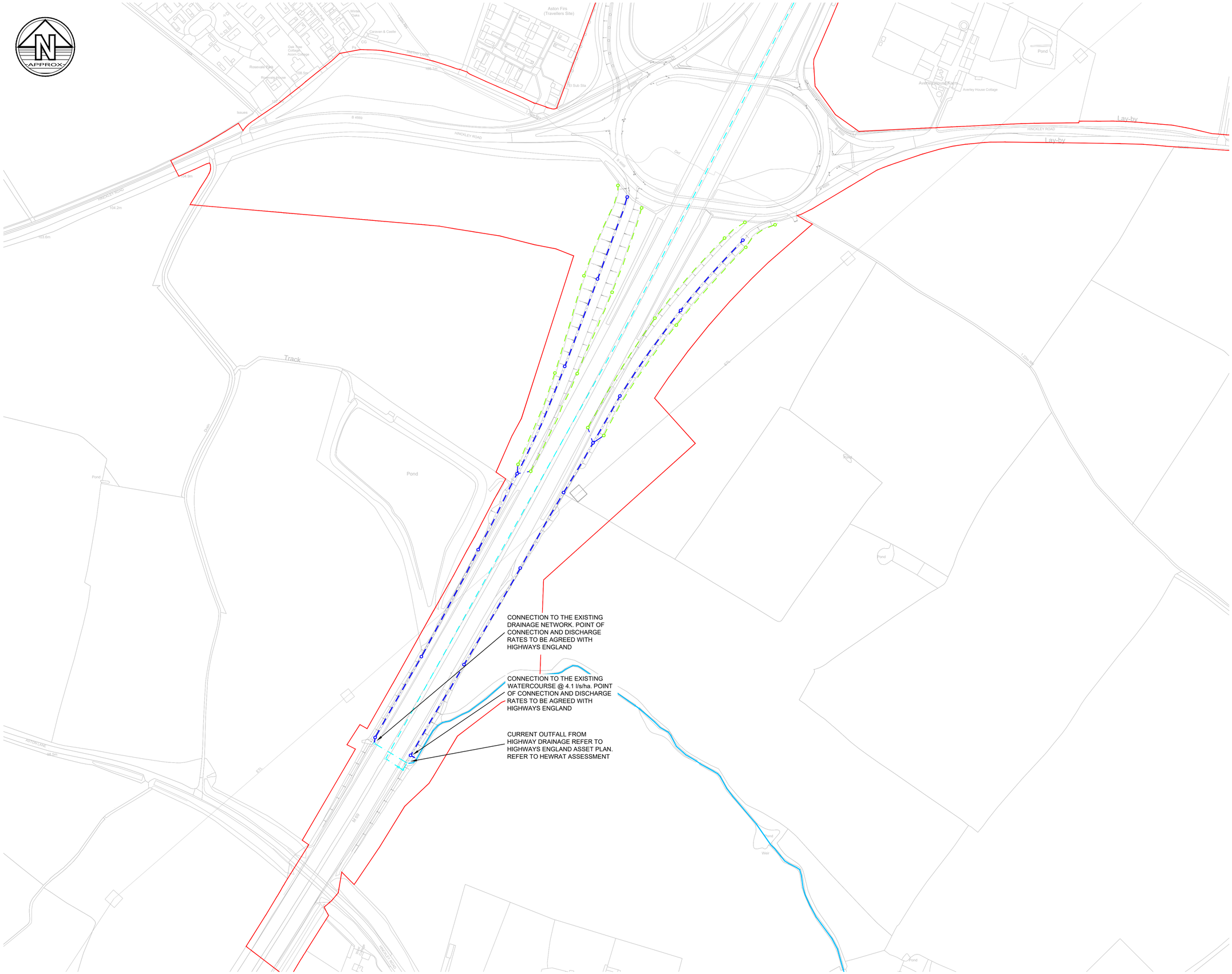

Notes

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2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.
5. Drawing provided for illustrative purposes only. Design subject to further coordination and approvals.
6. Layout based on AJA drawing: 5905-177.
7. Attenuation indicatively sized for the 1 in 100 year storm event plus a 20% allowance for climate change for the estimated impermeable areas. Allowance made for 650m^3 storage per 1ha of impermeable area. To be agreed with the LLFA.
8. Equivalent greenfield runoff rates have been estimate to be 4.1 l/s/ha. To be agreed with the LLFA.
9. Existing drainage shown indicatively for illustrative purposes. point of connection and proposed discharge rates to be agreed with Highways England.

Legend

- APPLICATION BOUNDARY
- EXISTING WATERCOURSE
- EXISTING DRAINAGE
- INDICATIVE SURFACE WATER FILTER DRAIN TO SERVE PROPOSED HARD SURFACING
- INDICATIVE SURFACE WATER FILTER DRAIN TO SERVE PROPOSED EMBANKMENTS

Rev	Date	Details of issue / revision	Drw	Rev
P01	05.09.22	Preliminary Issue	RJ	CD

Issues & Revisions

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www.bwbconsulting.com

Client

TRITAX SYMMETRY

Project Title

HINCKLEY RAIL FREIGHT INTERCHANGE

Drawing Title

M69 JUNCTION 2 DRAINAGE STRATEGY PLAN

Drawn:	RJ	Reviewed:	CD
BWB Ref:	NTT 2814	Date: 05.09.22	Scale@A1: 1:2000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
HRF-BWB-EWE-ZZ-DR-CD-00505	S2	P01

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APPENDICES

Appendix 10: HEWRAT

Highways England Water Risk Assessment Tool

Version 2.0.4 June 2019

Soluble

EQS - Annual Average Concentration

	Copper	Zinc	
Step 2	- Tier 1 fail. Go to Tier 2 (using UK TAG M-BAT tool), or Step 3 mitigation.	- Tier 1 fail. Go to Tier 2 (using UK TAG M-BAT tool), or Step 3 mitigation.	ug/l
Step 3	-	-	ug/l

Acute Impact

Copper	Zinc
Runoff Fails Toxicity Test. Try River Impact.	Runoff Fails Toxicity Test. Try River Impact.

Sediment - Chronic Impact

Runoff Fails Toxicity Test. Try River Impact.

Sediment deposition for this site is judged as:

Accumulating?	-	-	Low flow Vel m/s
Extensive?	-	-	Deposition Index

Road number	M69		HE Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	446310	Northing	293640	
OS grid reference of outfall structure (m)	Easting	446050	Northing	293100	
Outfall number	SP4693 0609c		List of outfalls in cumulative assessment		
Receiving watercourse	UOW associated with Lower Soar				
EA receiving water Detailed River Network ID			Assessor and affiliation		
Date of assessment			Version of assessment		
Notes					

Step 1 Runoff Quality

AADT: >10,000 and <50,000

Climatic region: Warm Dry

Rainfall site: Birmingham (SAAR 750mm)

Step 2 River Impacts

(Enter zero in Annual Q_{95} river flow box to assess Step 1 runoff quality only)

Annual Q_{95} river flow (m^3/s)	0	
Impermeable road area drained (ha)	0.9	
Permeable area draining to outfall (ha)	0	
Base Flow Index (BFI)	0.5	D

Freshwater EQS limits:

Bioavailable dissolved copper (µg/l)	1	D
Bioavailable dissolved zinc (µg/l)	10.9	D

Is the discharge in or within 1 km upstream of a protected site for conservation? No D

For dissolved zinc only — Water hardness: Low = <50mg CaCO3/l D

For dissolved copper only — Ambient background concentration (µg/l): 0 D

For sediment impact only — Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? No D

Tier 1 — Estimated river width (m): 5

Tier 2 — Bed width (m): 3; Manning's n: 0.07 D; Side slope (m/m): 0.5; Long slope (m/m): 0.0001

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures		0 D	No restriction D	0 D
Proposed measures		0 D	No restriction D	0 D

Highways England Water Risk Assessment Tool

Version 2.0.4 June 2019

Soluble

EQS - Annual Average Concentration

	Copper	Zinc	
Step 2	0.18	0.45	ug/l
Step 3	-	-	ug/l

Acute Impact

Copper	Zinc
Pass	Pass

Sediment - Chronic Impact

Fail. Try Tier 2 for Velocity

Settlement needed = 33 %, proposed = 0 %

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.00	Low flow Vel m/s
Extensive?	Yes	149	Deposition Index

Road number	M69		HE Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	446310	Northing	293640	
OS grid reference of outfall structure (m)	Easting	446050	Northing	293100	
Outfall number	SP4693 0609c		List of outfalls in cumulative assessment		
Receiving watercourse	UOW associated with Lower Soar				
EA receiving water Detailed River Network ID			Assessor and affiliation		
Date of assessment			Version of assessment		
Notes					

Step 1 Runoff Quality

AADT: >10,000 and <50,000

Climatic region: Warm Dry

Rainfall site: Birmingham (SAAR 750mm)

Step 2 River Impacts

(Enter zero in Annual Q_{95} river flow box to assess Step 1 runoff quality only)

Annual Q_{95} river flow (m^3/s)	0.003	
Impermeable road area drained (ha)	3.6	
Permeable area draining to outfall (ha)	289	
Base Flow Index (BFI)	0.5	D

Freshwater EQS limits:

Bioavailable dissolved copper (µg/l)	1	D
Bioavailable dissolved zinc (µg/l)	10.9	D

Is the discharge in or within 1 km upstream of a protected site for conservation? No D

For dissolved zinc only — Water hardness: Low = <50mg CaCO3/l D

For dissolved copper only — Ambient background concentration (µg/l): 0 D

For sediment impact only — Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? No D

Tier 1 — Estimated river width (m): 5

Tier 2 — Bed width (m): 1.5; Manning's n: 0.07 D; Side slope (m/m): 0.5; Long slope (m/m): 0.01

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures		0 D	No restriction D	0 D
Proposed measures		0 D	No restriction D	0 D

Highways England Water Risk Assessment Tool

Version 2.0.4 June 2019

Soluble

EQS - Annual Average Concentration

	Copper	Zinc	
Step 2	0.18	0.45	ug/l
Step 3	-	-	ug/l

Acute Impact

Copper	Zinc
Pass	Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	No	0.11	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Road number	M69		HE Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	446310	Northing	293640	
OS grid reference of outfall structure (m)	Easting	446050	Northing	293100	
Outfall number	SP4693 0609c		List of outfalls in cumulative assessment		
Receiving watercourse	UOW associated with Lower Soar				
EA receiving water Detailed River Network ID			Assessor and affiliation		
Date of assessment			Version of assessment		
Notes					

Step 1 Runoff Quality

AADT: >10,000 and <50,000

Climatic region: Warm Dry

Rainfall site: Birmingham (SAAR 750mm)

Step 2 River Impacts

(Enter zero in Annual Q_{95} river flow box to assess Step 1 runoff quality only)

Annual Q_{95} river flow (m^3/s)	0.003	
Impermeable road area drained (ha)	3.6	
Permeable area draining to outfall (ha)	289	
Base Flow Index (BFI)	0.5	D

Freshwater EQS limits:

Bioavailable dissolved copper (µg/l)	1	D
Bioavailable dissolved zinc (µg/l)	10.9	D

Is the discharge in or within 1 km upstream of a protected site for conservation? No D

For dissolved zinc only — Water hardness: Low = <50mg CaCO3/l D

For dissolved copper only — Ambient background concentration (µg/l): 0 D

For sediment impact only — Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? No D

Tier 1 — Estimated river width (m): 5

Tier 2 — Bed width (m): 1.5; Manning's n: 0.07 D; Side slope (m/m): 0.5; Long slope (m/m): 0.01

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures		0 D	No restriction D	0 D
Proposed measures		0 D	No restriction D	0 D

highways england

View Parameters | Reset Spillage Risk | Go To Interface

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

			Additional columns for use if other roads drain to the same outfall						
		A (main road)	B	C	D	E	F		
D1	Water body type	Surface watercourse							
D2	Length of road draining to outfall *(m)*	700							
D3	Road Type *(A-road or Motorway)*	M							
D4	If A road, is site urban or rural?								
D5	Junction type	Slip road							
D6	Location (response time for emergency services)	< 20 minutes							
D7	Traffic flow (AADT two way)	28,021							
D8	% HGV	40							
D8	Spillage factor *(no/10^9 HGVkm/year)*	0.43							
D9	Risk of accidental spillage	0.00123	0.00000	0.00000	0.00000	0.00000	0.00000		
D10	Probability factor	0.45							
D11	Risk of pollution incident	0.00055	0.00000	0.00000	0.00000	0.00000	0.00000		
D12	Is risk greater than 0.01?	**No**						**Totals**	**Return Period (years)**
D13	Return period without pollution reduction measures	0.00055	0.00000	0.00000	0.00000	0.00000	0.00000	0.0006	1805
D14	Existing measures factor	1							
D15	Return period with existing pollution reduction measures	0.00055	0.00000	0.00000	0.00000	0.00000	0.00000	0.0006	1805
D16	Proposed measures factor	1							
D17	Residual with proposed Pollution reduction measures	0.00055	0.00000	0.00000	0.00000	0.00000	0.00000	0.0006	1805

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Spillage Factor

Location	Serious Accidental Spillages *(Billion HGV km/ year)*	Motorways	Rural Trunk	Urban Trunk
	No junction	0.36	0.29	0.31
	Slip road	0.43	0.83	0.36
	Roundabout	3.09	3.09	5.35
	Cross road	-	0.88	1.46
	Side road	-	0.93	1.81
	Total	0.37	0.45	0.85

Indicative Pollution Risk Reduction Factors for Spillages

System	Optimum Risk Reduction Factor
Filter Drain	0.6
Grassed Ditch / Swale	0.6
Pond	0.5
Wetland	0.4
Soakaway / Infiltration basin	0.6
Sediment Trap	0.6
Unlined Ditch	0.7
Penstock / valve	0.4
Notched Weir	0.6
Oil Separator	0.5

The worksheet should be read in conjunction with DMRB 11.3.10.

APPENDICES

Appendix 11: Pre-Development Enquiry Response

WONDERFUL ON TAP

SEVERN TRENT

Severn Trent Water Ltd
Leicester Water Centre
Gorse Hill
Anstey
Leicester
LE7 7GU

Tel: 02477 716843

[redacted]@severntrent.co.uk

Contact: Belal Ali

Our ref: 8458909

BWB Consulting
5th Floor
Waterfront House
Station Street
Nottingham
NG2 3DQ

F.A.O: Rowan Jobling

22nd March 2021

Dear Sir/Madam,

Proposed Commercial Development (14 units 639,400m2) Land at Hinckley Rail Freight Interchange, Land north east of Hinckley Leicestershire – 446281 294948

I refer to your Development Enquiry Request in respect of the above site. Please find enclosed the sewer records that are included in the fee together with the Supplementary Guidance Notes (SGN) referred to below.

Public Sewers in Site – Required Protection

Records show there is a 517mm public pressurised sewer within the site boundary. Please be advised that this sewer will require a 20m protective strip, 10m on each side of pipe centreline.

Due to a change in legislation on 1 October 2011 there may be former private sewers on the site which have transferred to the responsibility of Severn Trent Water Ltd, which are not shown on the statutory sewer records, but are located in your client's land. These sewers would require protective strips of 3 metres either side of the sewer's centreline that we will not allow to be built over. If such sewers are identified to be present on the site, please contact us for further guidance.

There is no guarantee that you will be able to build over or close to any Severn Trent sewers, and where diversion is required there is no guarantee that you will be able to undertake those works on a self-lay basis. Every approach to build near to or divert our assets has to be assessed on its own merit and the decision of what is or isn't permissible is taken based on the

risk to the asset and the wider catchment it serves. It is vital therefore that you contact us at the earliest opportunity to discuss the implications of our assets crossing your site. Failure to do so could significantly affect the costs and timescales of your project if it transpires diversionary works need to be carried out by Severn Trent.

Foul Water Drainage

The sewer records show the nearest connection point would be the 150mm public foul water sewer to the North East of the site. This sewer connects downstream to the Elmesthorpe – Bostock Close Sewage Pumping Station (SPS) and Elmesthorpe – Bostock Close Combined Sewer Overflow (CSO).

We have previously modelled this development to MH SP47950601 and results demonstrated high risk of external flooding, pollution and insufficient capacity on SPS from additional foul flows. It is assumed the site will require a pump solution due to land contour. Site was modelled using flows at 14.5 l/s, let us know when you have more information on pump specification.

Please inform us as and when the site has been submitted for planning as this will prioritise and determine how quickly we pass the site over to Growth promotions Team to consider options for upgrade to the network. Further detail about your proposed build schedule and phasing would be useful too.

Surface Water Drainage

Under the terms of Section H of the Building Regulations 2000, the disposal of surface water by means of soakaways should be considered as the primary method. If these are found to be unsuitable, satisfactory evidence will need to be submitted. The evidence should be either percolation test results or by the submission of a statement from the SI consultant (extract or a supplementary letter).

Subject to the above, the site drainage should be discussed with the Local Lead Flood Authority with a view to implement suitable SUDs techniques to land soakaways or other land drainage systems. Any discharge rate to a watercourse or drainage ditch will be determined by the LLFA.

Connections

For any new connections (including the re-use of existing connections) to the public sewerage system, the developer will need

to submit a Section 106 application form. Our Developer Services department are responsible for handling all new connections enquiries and applications. To contact them for an application form and associated guidance notes please call 0800 7076600 or download from [redacted]

Please quote the above reference in any future correspondence (including e-mails) with STW Limited. Please note that Developer Enquiry responses are only valid for 6 months from the date of this letter.

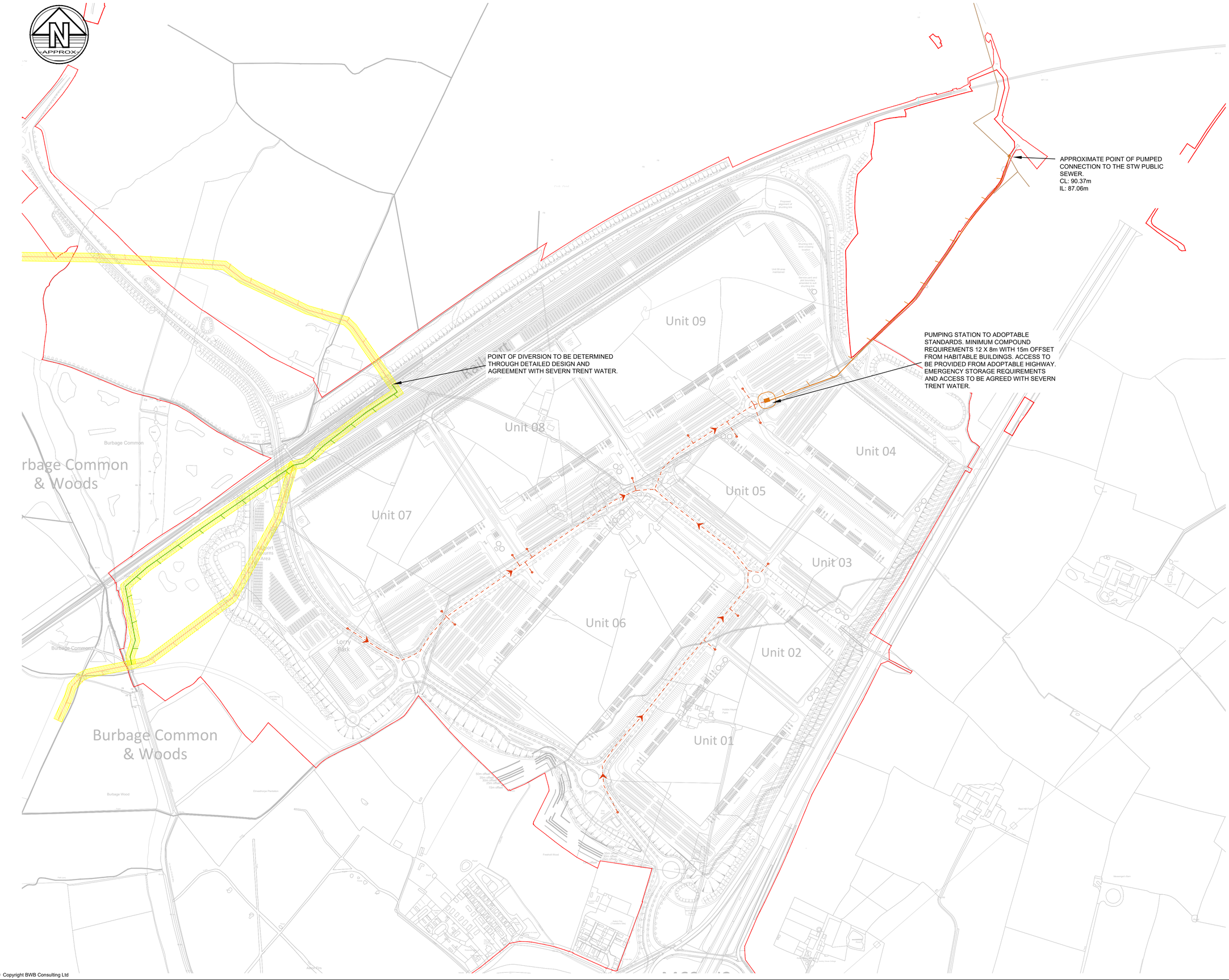
Yours sincerely

[redacted]

Belal Ali
Asset Protection Waste Water East
Wholesale Network Control and Asset Management

APPENDICES

Appendix 12: Concept Foul Drainage Strategy



Notes

1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.
5. Drawing provided for illustrative purposes only. Design subject to further coordination and approvals.
6. Layout based on AJA drawing: 5905-177.
7. Foul water connection and site wide pumping requirements to be discussed and agreed with Severn Trent Water.
8. Foul water pumping station to be located above the 1 in 200 year flood extent.

Legend

- APPLICATION BOUNDARY
- EXISTING SEVERN TRENT WATER PUBLIC FOUL SEWER
- INDICATIVE FOUL WATER DRAINAGE RUN
- FOUL PUMPING STATION AND RISING MAIN
- APPROXIMATE LOCATION OF EXISTING RISING MAIN WITH 20m EASEMENT
- POTENTIAL DIVERSION ROUTE. TO BE AGREED WITH SEVERN TRENT WATER

Rev	Date	Details of issue / revision	Drw	Rev
P06	21.11.22	Diversion route updated	RJ	CD
P05	11.08.22	Existing Rising Main / Diversion added	RJ	CD
P04	18.07.22	Text Amendments	CMD	CD
P03	14.12.21	Updated DCO boundary	RJ	CD
P02	01.10.21	Updated to latest masterplan	RJ	CD
P01	10.09.21	Preliminary Issue	RJ	CD

Issues & Revisions

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Client
TRITAX SYMMETRY

Project Title
HINCKLEY RAIL FREIGHT INTERCHANGE

Drawing Title
CONCEPT FOUL DRAINAGE STRATEGY PLAN

Drawn:	RJ	Reviewed:	CD
BWB Ref:	NTT 2814	Date: 10.09.21	Scale@A1: 1:4000

Drawing Status
PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
HRF-BWB-EWE-ZZ-DR-CD-00504	S2	P06

X:\NTT\NTT2814_Hinckley Rail Freight Interchange\02. Project Delivery\01. WIP\Drawings\Water\HRF-BWB-EWE-ZZ-DR-CD-00504_Concept Foul Drainage Strategy P05.dwg