

Flood Risk Assessment & SuDS Strategy

MIRA Lab Extension
Watling Street
Nuneaton

JMS Project Reference: CO23/O129/O2



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Revisions and Additional Material

Document History and Status

Revision	Date	Purpose/Status
A	03.07.2023	Client comments
-	29.06.2023	First Issue

Document Details

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Project Name	MIRA Lab Extension

Preamble

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1 Introduction

- 1.1 JMS Engineers has been appointed to prepare a Flood Risk Assessment (FRA) to support a planning application for an extension to an existing workshop at the MIRA Technology Park, which forms part of the larger MIRA vehicle testing facility near Nuneaton.
- 1.2 This assessment has been considered in accordance with local planning policies and guidance from Hinckley & Bosworth Borough Council and Leicestershire County Council.
- 1.3 The purpose of this assessment is to review the proposed development and consider the flood risks associated with the proposal. The risks of flooding and potential impact from alterations to the site drainage, and the surface water characteristics are considered within the scope of the parameters set out in the National Planning Policy Framework (NPPF).
- 1.4 This document has been produced in accordance with the Technical Guidance to the NPPF and the Flood Risk and Coastal Change Planning Policy Practice Guidance (PPG) and is based on the evidence provided by the Environment Agency (EA).
- 1.5 Consideration has been given to the ODPM document Preparing for Floods which is a “*guide intended for use by developers, local planning authorities and others involved in construction of new buildings, and renovation of existing building at risk of flooding. If adopted the principles set out within this guide should help reduce the stress and disruption of flooding and provide a more sustainable approach to flood risk*”.

2 Location & Existing Conditions

- 2.0.1 The application site is centred around Ordnance Survey (OS) grid reference 436346 295308. The current Technology Park site area is approximately 5.7ha. At present the site is occupied by a mixture of buildings and other areas of hardstanding such as car parks. The majority of the site is impermeable.
- 2.0.2 A topographical survey of the area to be built on has been undertaken, this can be found in **Appendix A**.
- 2.0.3 The Technology Park sits immediately to the north of the A5, to the north of Nuneaton. The indicative location is shown as **Figure 1**, below.

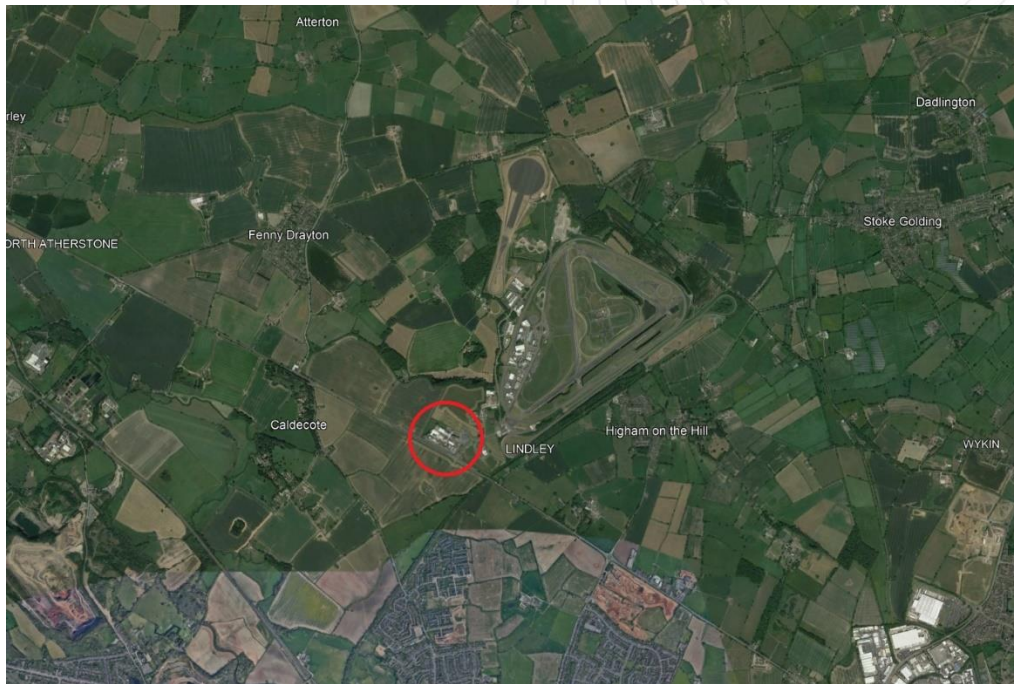


Figure 1 - Site location

- 2.0.4 Nearby British Geological Survey (BGS) borehole data indicate that the site is underlain by clay and sandstone. BGS records are contained in **Appendix B**.

2.1 Existing Sewer Assets

- 2.1.1 Severn Trent Water asset plans indicate that there are no surface water sewers in the vicinity of the site. A copy of the plan for the area is contained in **Appendix C**.

2.2 Site Proposals

- 2.2.1 It is proposed to extend one of the lab buildings to the west on to land that is currently a field. A plan showing the proposed extension within the wider site is contained in **Appendix D**.

2.3 Existing Drainage Regime

- 2.3.1 At present the Technology Park site drains to an existing watercourse which crosses the site.

3 Planning Policy Context

3.1 National Planning Policy

- 3.1.0 The National Planning Policy Framework (NPPF, 2021) includes government policy on development and in this case meeting the challenge of climate change and flood risk. The policy states; *“Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk....”*
- 3.1.1 The location of new developments should consider climate change by planning to avoid increasing the vulnerability on development from the impacts of climate change. Where locations are considered vulnerable from the impacts of climate change, these risks should be managed and where possible mitigated to limit the risk.
- 3.1.2 Development in areas at risk of flooding should be made safe without increasing the flood risk elsewhere. Local Plans should be based on evidence, through a Sequential Test, in selecting the appropriate location for new development within the plan period and thus avoiding where possible flood risk to people and property.
- 3.1.3 Development priorities are based on the specific flood risk zones outlined within Table 1 of the technical guidance, as per **Table 1** below. For Flood Zone 1 – Low probability. Land assessed as having a less than 1 in 1,000-year annual probability of river and sea flooding (<0.1%) in any year.

Flood Zones	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as ‘clear’ on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding (Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water must flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

Table 1 - Flood Zone Definitions

- 3.1.4 The Environment Agency (EA) website confirms the site location to be within Flood Zone 1. In this case, there is no requirement to carry out a sequential or exception test.
- 3.1.5 Further guidance in NPPF classifies retail schemes to be a ‘less vulnerable’ land class use in terms of flood risk, as shown in **Table 2**, below.

Flood Risk Vulnerability Classification: Less Vulnerable	
Hospitals	
Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels	
Buildings used for dwelling houses, student halls of residence, drink establishments, nightclubs and hotels	
Non-residential uses for health services, nurseries and educational establishments, retail, offices, industry	
Landfill and sites used for waste management facilities for hazardous waste	
Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan	

Table 2 - Flood Risk Vulnerability Classifications

- 3.1.6 NPPG Table 3 (para 67 ID 7-067-20140306) determines the appropriate uses by flood zone, in this case a less vulnerable use for retail is appropriate for a Zone 1 as summarised in PPS25, table D.1, shown below as **Table 3**.

Flood Zones		Flood Risk Vulnerability Classification			
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test Required	✓	✓	✓
Zone 3a	Exception Test Required	x	Exception Test Required	✓	✓
Zone 3b	Exception Test Required	x	x	x	✓

Table 3 - Flood Risk Vulnerability and Flood Zone Compatibility

- 3.1.7 The EA mapping indicates that the site is entirely located within Flood Zone 1 and therefore is located to meet the requirements of NPPF.

3.2 Local Planning Policy

- 3.2.0 Hinckley & Bosworth Site Allocations and Development Management Policies DPD (2016)

Policy DM7, Preventing Pollution and Flooding, states that development proposed must not create or exacerbate flooding, by being located away from areas of flood risk.

- 3.2.1 Hinckley & Bosworth Draft Local Plan, 2020-2039 (2021, not yet adopted)

Policy CCo2 states that flood risk from all sources should be avoided or managed.

Policy CCo3 states that SuDS should be utilised.

4 Flooding Assessment

4.1 Flood Risk

- 4.1.1 In the case of the proposed development; the site is located within Flood Zone 1 as indicated on the flood mapping shown as **Figure 2**, below.

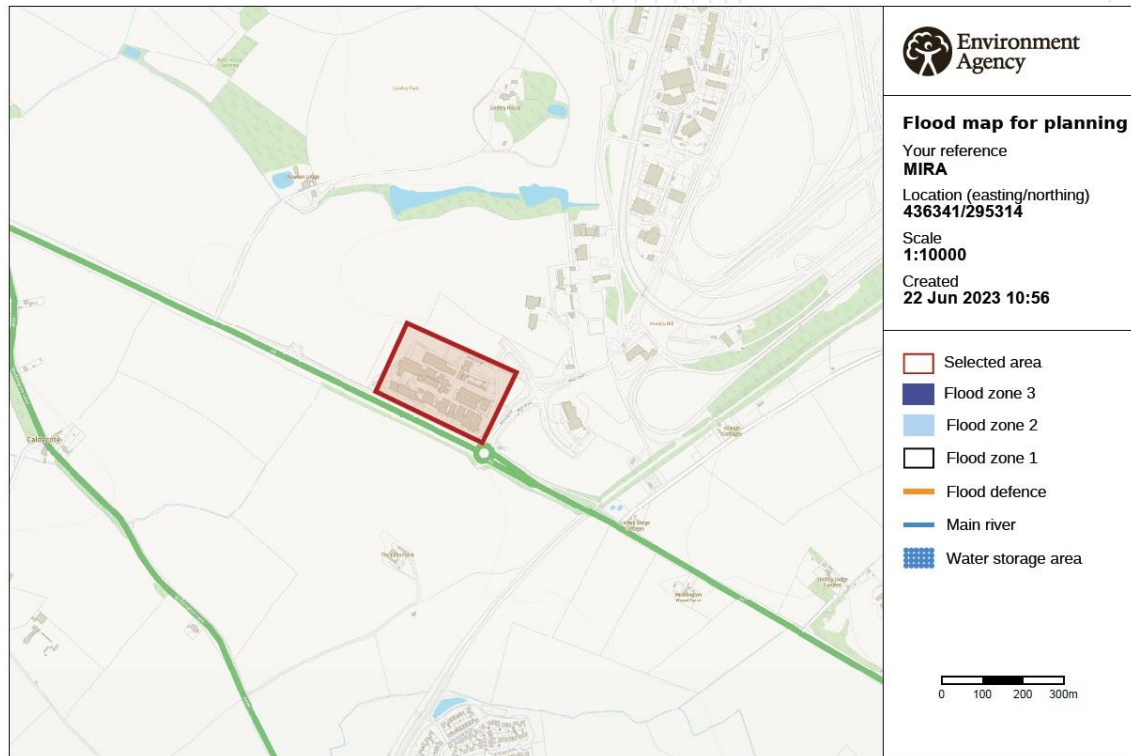


Figure 2 - EA Flood Zone Mapping

4.2 Flooding from Surface Water

- 4.2.1 Pluvial flooding refers to the flooding event as a result of extreme rainfall which cannot be absorbed within the ground, or the urban drainage system becoming overwhelmed. The mapping indicates a very low risk of surface water flooding for the majority of the site, with a high risk for some areas in the immediate vicinity of the watercourse that crosses the site, as per **Figure 3** below.

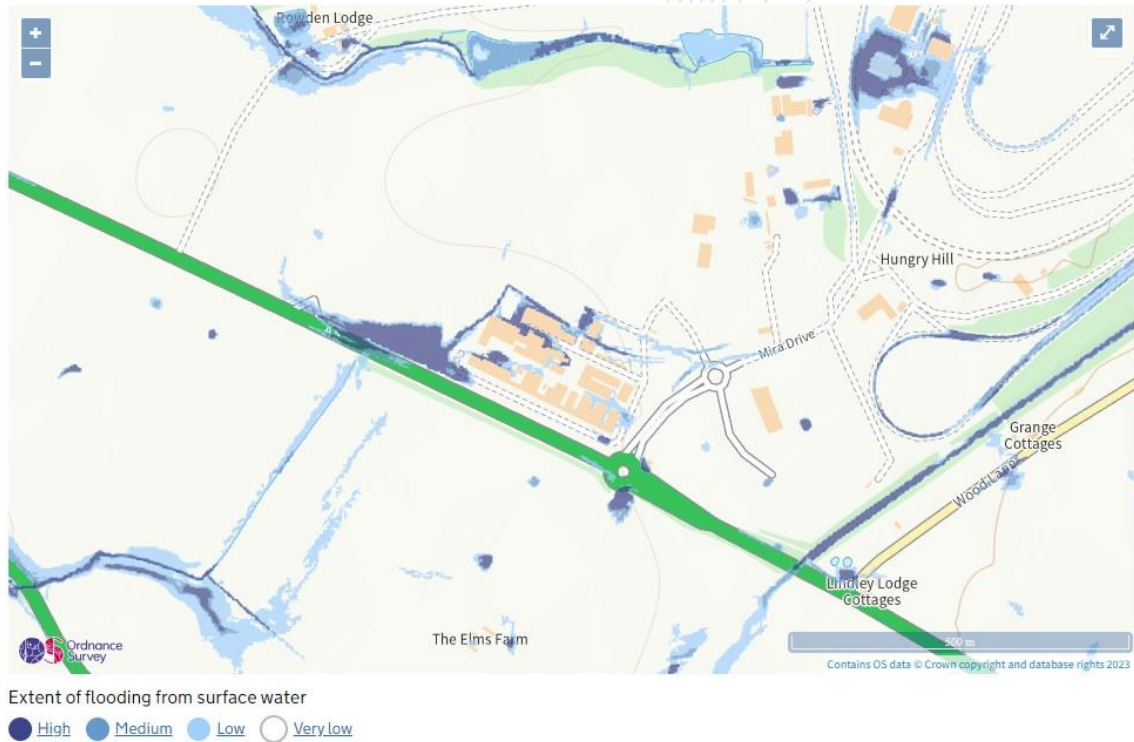


Figure 3 - Surface Water Flood Map

4.3 Flooding from Rivers or the Sea

- 4.3.1 Fluvial flooding is a result of the capacity of rivers being exceeded by the river flow. In general, rivers have a natural flood plain, which can sometimes be encroached upon by development.
- 4.3.2 Tidal flooding is a result from the sea where high tides and storm surges raise the level of tidal waters above the level of the shore or riverbanks. These can be sudden and severe. Due to the site's inland location, the site is not considered to be at risk of tidal flooding.
- 4.3.3 As shown on **figure 5**, below, the site is not predicted to be affected by flooding from rivers or the sea.

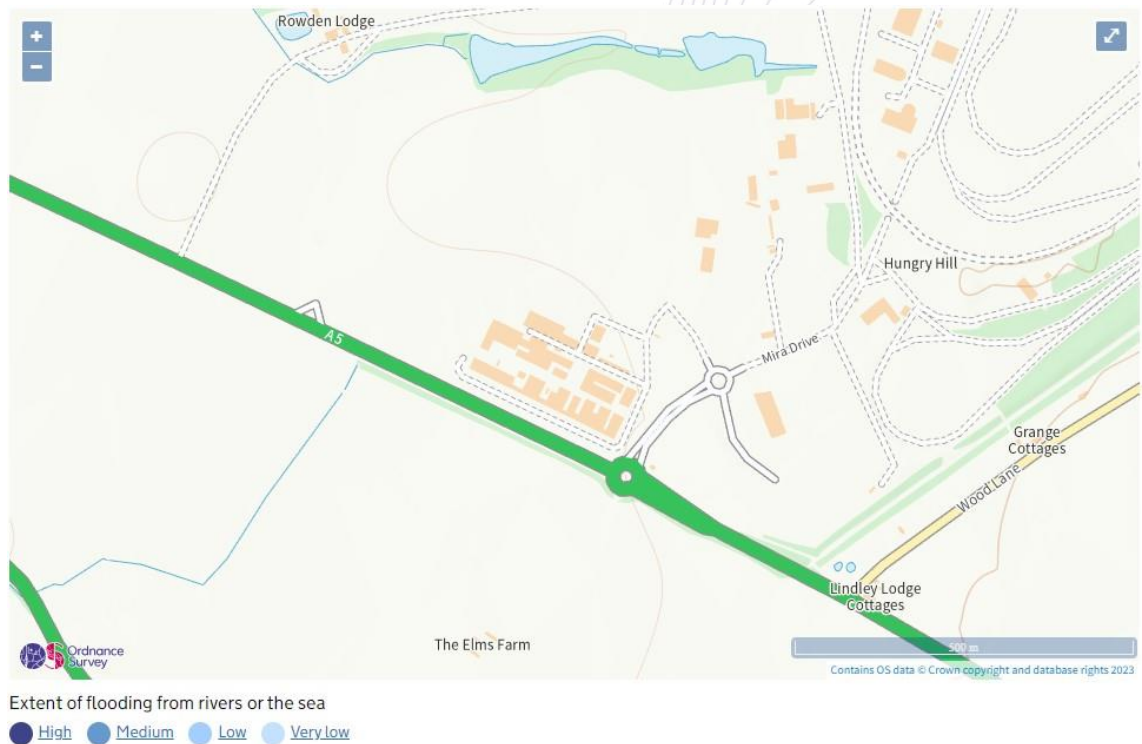


Figure 4 – River Flood Map

4.4 Infrastructure failure

4.4.1 Infrastructure failure: ‘Canals, reservoirs, industrial processes, burst water mains or failed pumping stations’. An extract of the flood risk from reservoirs map, which demonstrates that the site is not at risk of flooding from reservoirs or other artificial water bodies, is shown as **Figure 4**, below:

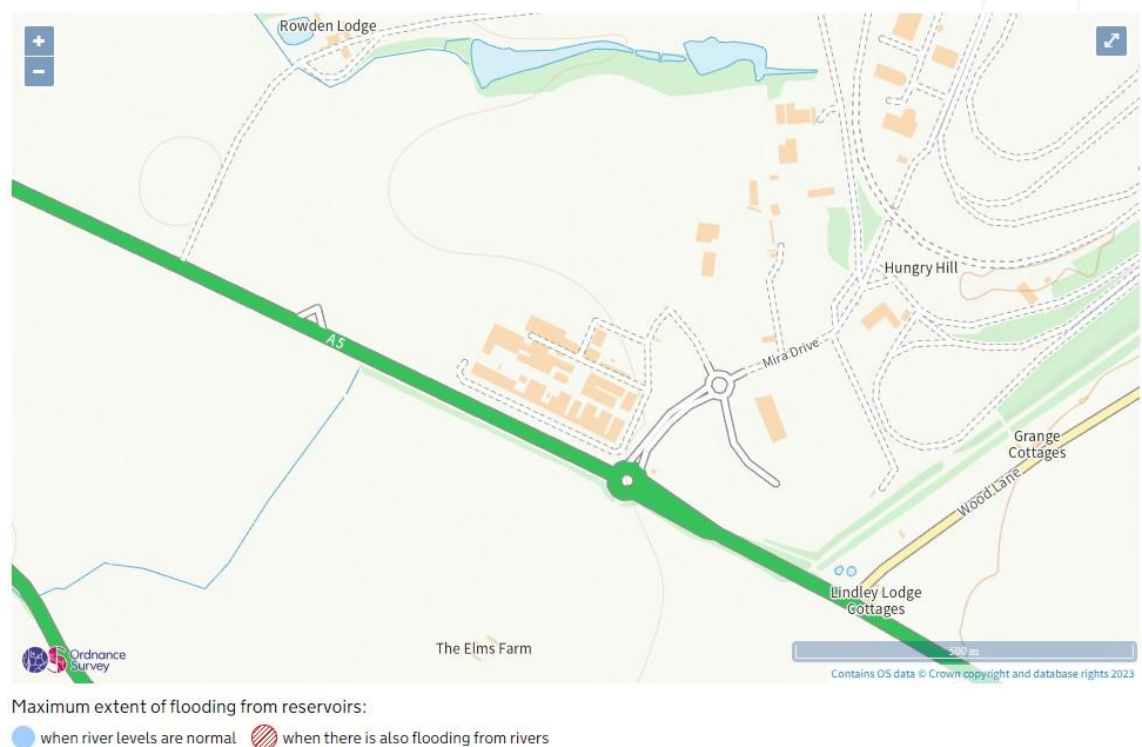


Figure 5 - Reservoir Flood Map

5 SuDS Considerations

- 5.0.1 Consideration of SuDS is a planning requirement for new developments. SuDS are designed to replicate the natural course of drainage as closely as possible with a view to reducing the impact of flooding, removing pollutants at source and combining water management with green space.
- 5.0.2 Developments should utilise SuDS where possible and ensure that surface water run-off is managed as close to its source as possible in line with the following hierarchy:
1. Into ground (infiltration).
 2. To a surface water body.
 3. To a surface water sewer.
 4. To a combined sewer.
- 5.0.3 Sustainable Drainage Systems should be included in the design in order to manage surface water flood risk. SuDS should be inspired by natural drainage processes and manage water as close to its source as possible whilst offering pollution control and landscape benefits.
- 5.0.4 The site currently discharges to a watercourse but does not appear to utilise SuDS.
- 5.0.5 As discussed in paragraph 2.0.4, the site is underlain by clay and is therefore considered unsuitable for infiltration.

5.1 SuDS Incorporation

- 5.1.1 The below table gives examples of various SuDS components that provide means of controlling surface water at source.

Component Type	Description	Collection Mechanism	Design Criteria						
			Water Quantity (Chapter 3)			Water Quality (Chapter 4)	Amenity (Chapter 5)	Biodiversity (Chapter 6)	Further Information (Chapter Ref)
			Peak Runoff Rate	Runoff Volumes					
				Small Events (Interceptions)	Large Events				
Rainwater Harvesting Systems	Systems that collect runoff from the roof of a building or other paved surface for use	P		●	●		●		11
Green roofs	Planted soil layers on the roof of buildings that slow and store runoff	S	○	●		●	●	●	12
Infiltration systems	Systems that collect and store runoff, allowing it to infiltrate into the ground	P	●	●	●	●	●	●	13
Proprietary treatment systems	Subsurface structures design to provide treatment to runoff	P				●			14
Filter strips	Grass strips that promote sedimentation and filtration as runoff is conveyed over the surface	L		●		●	○	○	15
Filter drains	Shallow stone-filled trenches that provide attenuation, conveyance and treatment of runoff	L	●	○		●	○	○	16
Swales	Shallow landscaped depressions that allow runoff to pond temporarily on the surface, before filtering through vegetation and underlying soils	L	●	●	●	●	●	●	17

Bioretention systems	Trees with soil-filled tree pits, tree planters or structural soils used to collect, store and treat runoff	P	●	●	●	●	●	●	18
Trees	Structural paving through which runoff can soak and subsequently be stored in the sub-base beneath, and/or allowed to infiltrate into the ground below	P	●	●		●	●	●	19
Pervious pavements	Structural paving through which runoff can soak and subsequently be stored in the sub-base beneath, and/or allowed to infiltrate into the ground below	S	●	●	●	●	○	○	20
Attenuation storage tanks	Large, below-ground voided spaces used to temporarily store runoff before infiltration-controlled release or use	P	●						21
Detention basins	Vegetated depressions that store and treat runoff	P	●	●		●	●	●	22
Ponds and wetlands	Permanent pools of water used to facilitate treatment of runoff – runoff can also be stored in an attenuation zone above the pool	P	●			●	●	●	23
P-Point L-Lateral S-Surface ● – likely valuable contribution to delivery of design criterion ○ – some potential contribution to delivery of design criterion, if specifically included in the design									

Table 4 - CIRIA Table 7.1 SuDS Components

- 5.1.2 Is it proposed that surface water will be attenuated in a detention basin before being discharged to a ditch that crosses the site via a new headwall.
- 5.1.3 The design life of the development is likely to exceed the design life of any of the SuDS components listed above that are utilised on-site. During the routine inspections of any drainage components, it may become apparent that they have reached the end of their functional lifetime. In the interest of sustainability, repairs should be the first-choice solution where practicable. If this is not the case, then it will be necessary for the property owner to undertake complete replacement of the component in question.

6 Surface Water Strategy

6.0.1 The surface water strategy is based upon the SuDS implementation as outlined above:

A. Store rainwater for later use:

The user of the site may wish to utilise rainwater harvesting.

B. Use infiltration techniques, such as porous surfaces:

Upon review of the British Geological Survey Mapping data, the underlying ground conditions do not appear to support the use of infiltration techniques.

C. Attenuate rainwater in ponds or open water features for gradual release:

It is proposed that surface water will be attenuated in an online pond before discharging to a watercourse. A flow control has been proposed to restrict flows to 5.00l/s.

Microdrainage Calculations are contained in **Appendix E** and a Drainage Strategy plan is contained in **Appendix F**

D. Attenuate rainwater by storing in tanks or sealed water features for gradual release:

Not required. See above.

E. Direct rainwater direct to the watercourse:

It is proposed that the attenuated surface water be discharged to an existing ditch at a restricted rate of 5l/s.

F. Discharge rainwater to a surface water sewer/drain:

There are no surface water sewers in the vicinity.

6.1 Preliminary Surface Water Drainage Maintenance Schedule

6.1.1 This section of the report gives guidance on the maintenance of the drainage system and outlines who will be responsible for this. By necessity the available SuDS systems will control outfall flow, store and slow down rainwater.

6.1.2 Storage and Attenuation – Maintenance of the attenuation basin will be the responsibility of a Management Company, see **Table 5** below.

Maintenance Schedule	Required Action	Recommended Frequency
Regular Maintenance	Remove litter & debris	Monthly
	Cut grass-for spillways and access routes	Monthly (during growing season), or as required
	Cut grass-meadow grass in and around basin	Half yearly – Spring and Autumn
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)

	Inspect inlets and outlets and overflows for blockages and clear if required	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlets and forebay	Annually / as required
	Manage wetland plants in outlet pool	Annually – as set out in CIRIA C753 Chapter 23.
Occasional Maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every two years or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years / as required
Remedial Actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/Rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

Table 5 - System storage operation and maintenance requirements (Detention Basin)

6.1.3 The rainwater from the roofs is collected via rainwater pipes and will be carried to the attenuation. The maintenance of the collection system is the responsibility of the property owner, see **Table 6** below.

Maintenance Schedule	Required Action	Recommended Frequency
Regular Maintenance	Inspection of silt trap chamber and removal of debris when necessary	Quarterly or as required following monitoring
Remedial actions	Check for blockages in manholes and pipes. Rodding and jetting of pipes to be carried out. CCTV survey can be carried out to inspect condition of pipework.	Quarterly or as required following monitoring
Monitoring	Inspect collection apparatus for debris and litter. Remove where necessary to prevent blockages in the system	Monthly or after periods of heavy rainfall

Table 6 - System storage operation and maintenance requirements (Rainwater Pipes and Chambers)

5.2.5 The design life of the development is likely to exceed the design life of each of the SuDS components listed above. During the routine inspections of any drainage components it may become apparent that they have reached the end of their functional lifetime. In the interest of sustainability, repairs should be the first-choice

solution where practicable. If this is not the case, then it will be necessary for the property owner to undertake complete replacement of the component in question.

6.2.1 Existing Watercourse

6.2.2 The watercourse that much of the site currently drains to (including the proposed extension) partially sits within the footprint of the extension.

6.2.3 It is therefore proposed that the existing watercourse be culverted underneath the building. The flow rate of the existing channel has been calculated using Manning's equation:

$$Q = (1.49/n) * A * R^{(2/3)} * S^{(1/2)}$$

Where:

Q is the maximum flow rate (m³/s)

n is the Manning's roughness coefficient, assumed to be 0.04 for a grassy slope

A is the cross-sectional area of flow (m²)

R is the hydraulic radius (m, calculated as the area of flow / wetted perimeter)

S is the channel slope (expressed as a ratio)

6.2.4 A value for Q was calculated for three points along the section of the watercourse that is to be culverted, based on the site topographical survey. A plan showing the locations and cross sections for the three areas is contained in **Appendix H**.

6.2.5 The highest Q value was 7.8m³/s. Copies of the calculations are also contained in **Appendix H**. This is considered to be a robust calculation, as it assumes that the water is at the maximum possible level.

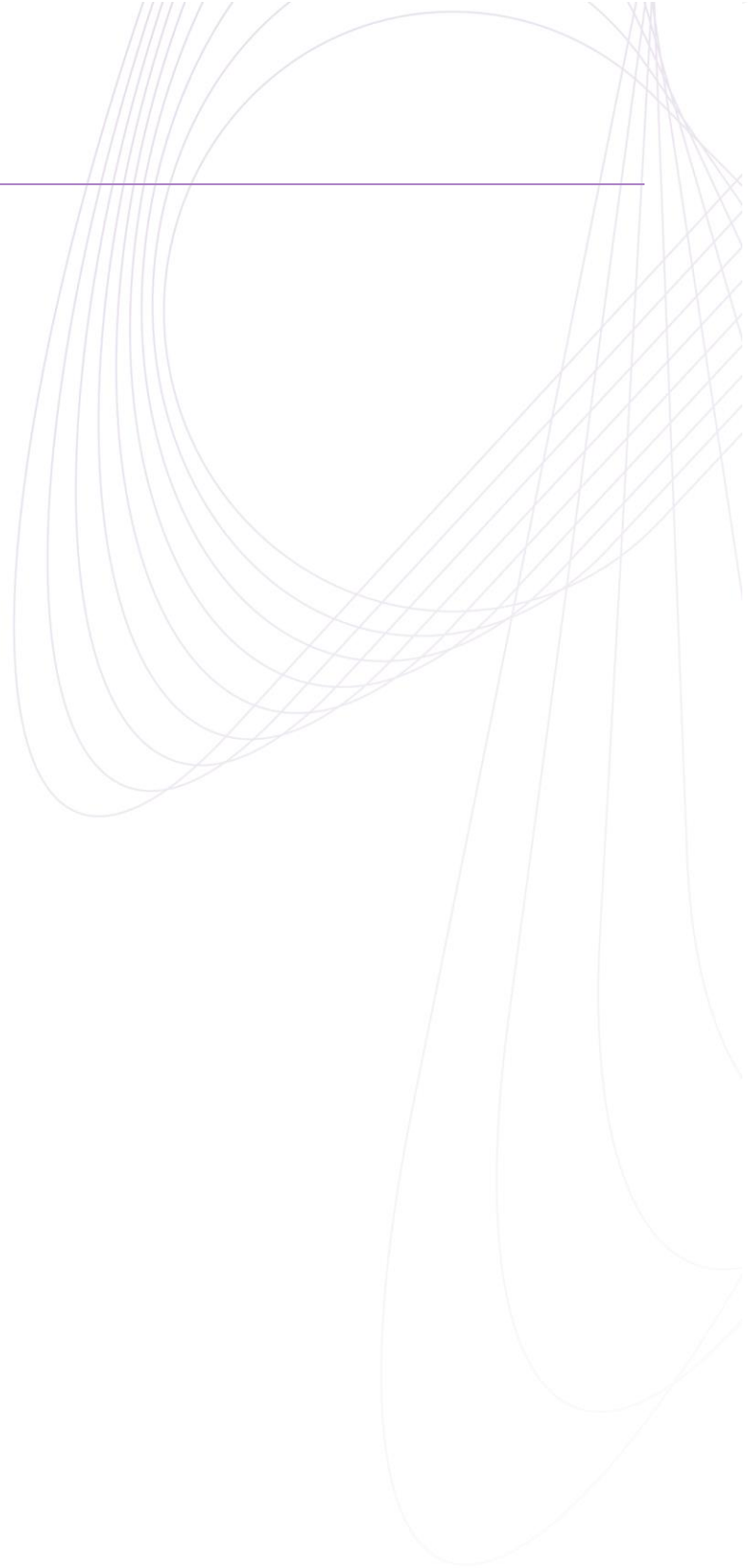
6.2.6 It is proposed to use a box culvert with a width of 2m and a height of 1m. Based on the Manning's equation, the culvert can accommodate a flow of 9.48m³/s. The proposed culvert is therefore sufficient to accommodate the maximum flow of the existing channel.

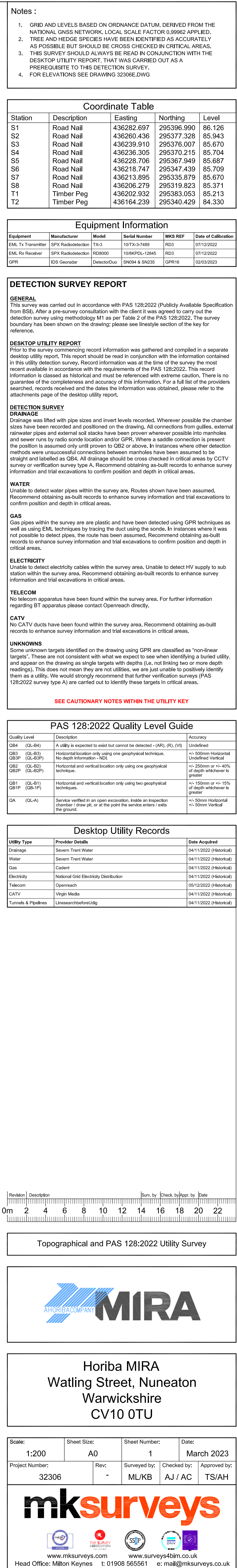
7 Summary and Conclusions

- 7.1 JMS Engineers have been appointed to prepare a Flood Risk Assessment and SuDS strategy to assist with the planning application for the extension of an existing workshop at the MIRA vehicle testing centre.
- 7.2 A review of the Environment Agency's mapping illustrates that the site is situated within Flood Zone 1, with low risk from Pluvial flooding.
- 7.3 Nearby BGS borehole data indicate that the site is underlain by clay and mudstone, the site is therefore considered to be unsuitable for infiltration.
- 7.4 Following the SuDS hierarchy, it is proposed that surface water from the proposed extension be attenuated on-site before being discharged to a watercourse at a restricted rate. This represents betterment over the current situation, as the land that the extension will be built on is currently 100% impermeable.
- 7.5 In considering the details set out in this report we find the proposed development is compliant with national policy, and the development layout can be accommodated at this location without increasing the flood risk or impacting the water quality discharging from the site.

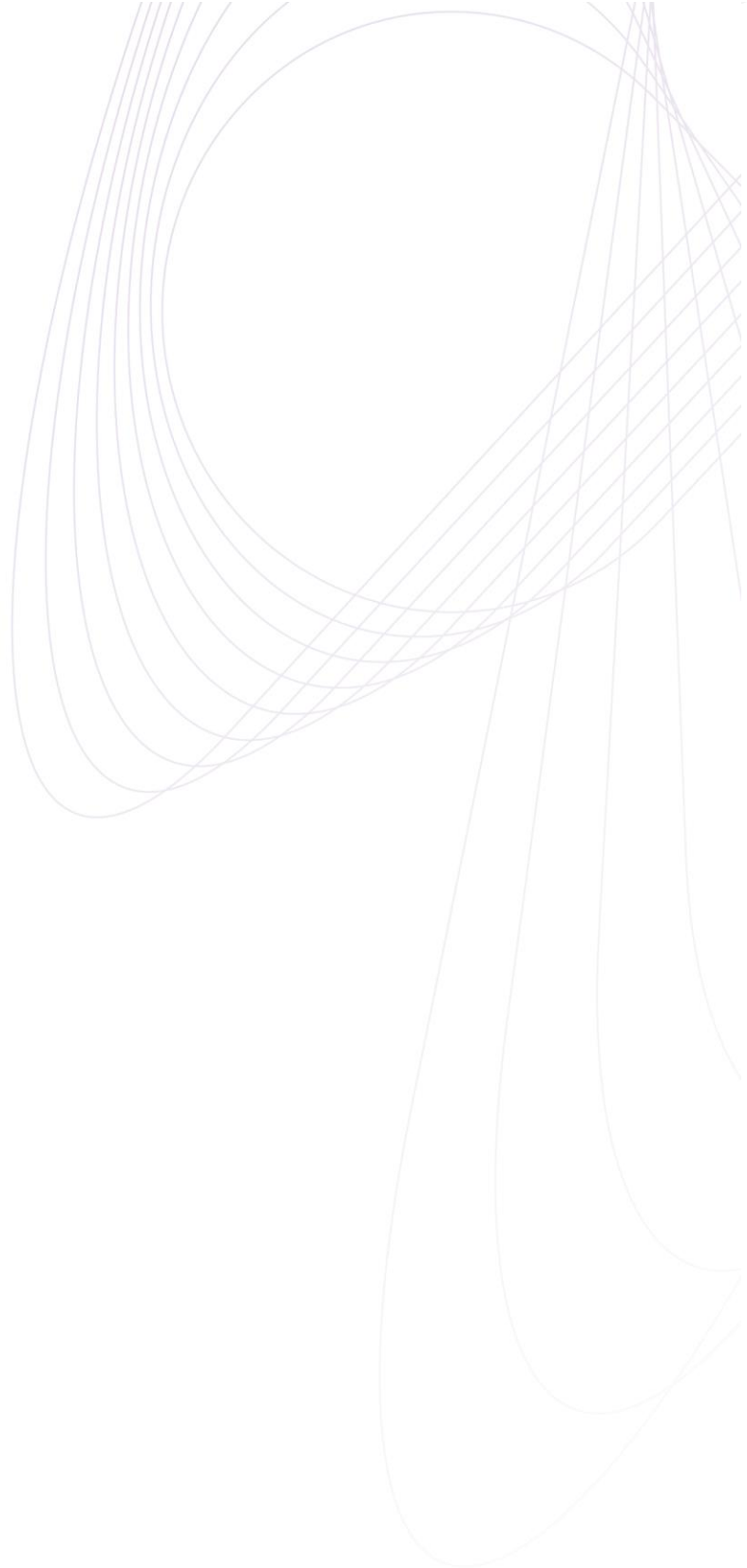
8 Appendices

Appendix A – Topographical Survey





Appendix B – BGS Borehole Data





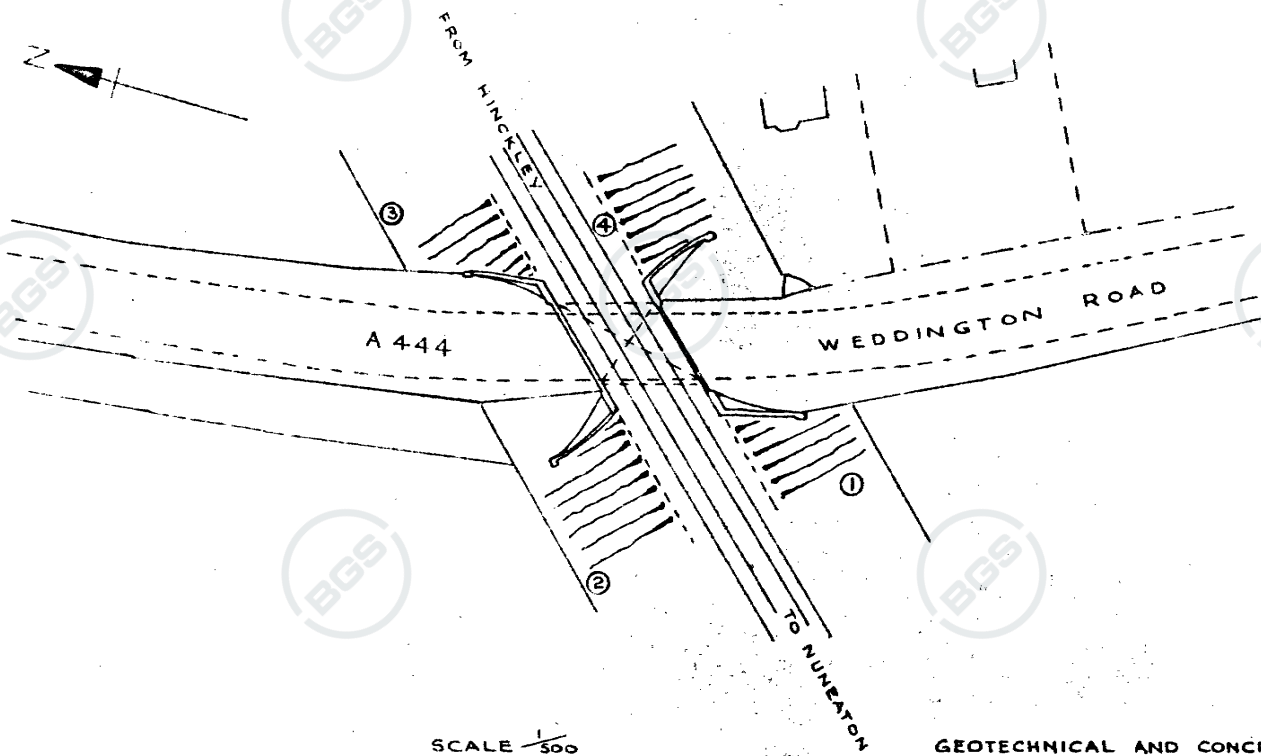
BOREHOLE RECORD SHEET

Job No. 1529 ~~SP 39SE/316~~
Location BRIDGE NO 39 NUNEATON
Carried out for LONDON MIDLAND REGION - BRITISH RAILWAYS BOARD
Borehole No. 3. Diameter 6 INCHES
Ground Level 267.97 A.O.D. Scale 1/4 INCH TO 1 FOOT
M.D. 81.67

Description	M/C. °	O.S.D.	Legend	Depth	Thickness	Sample	Water Levels
Soil		266.0		0.0			
		267.0		11.0	11.0		
Brown clayey sand and very sandy clay.					6.3	3/6 5/0	
						Δ 6/5	6/5 (2.2-64)
Stiff, red-brown, clay with hard marl. fragments		260.8		71.3	4.3	8/6 4/2	
Red Keuper Marl with some thin green bands.		256.5		111.6		13/6 15/0	
						18/6 19/6	
					(18/6)		
						23/6 25/0	
						0 26/0	
Very hard, silty, greenish fine sandstone.						28/6 30/0	
		238.0		30.0		End of Bore.	

Tested Sample: ☐ Corroded Sample: ☐ Water Sample: ☐ Standard Penetration: ☐

SKETCH PLAN SHOWING BOREHOLE POSITIONS



SCALE 1/500

GEOTECHNICAL AND CONCRETE SERVICES

REF No 1329 FEBRUARY 1964

SP39SE 314-317

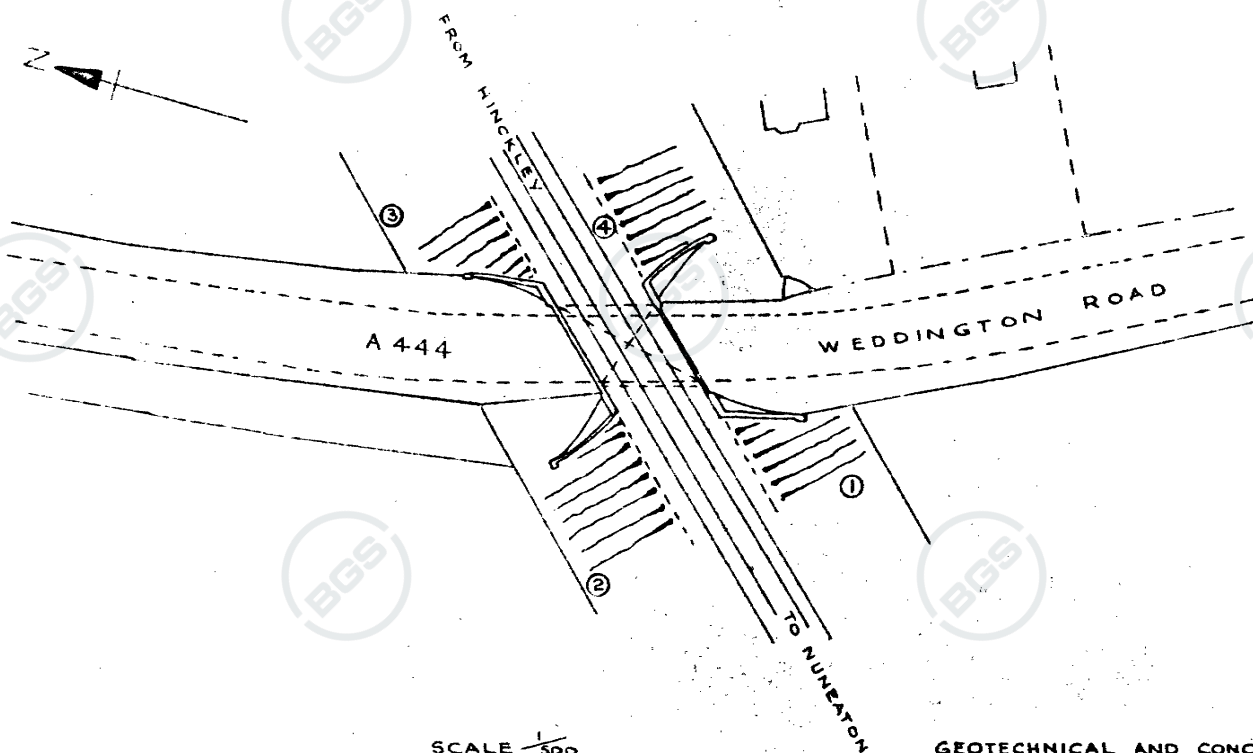
BOREHOLE RECORD SHEET

Job No. 1329 SP 3956/317
Location BRIDGE NO 39, NUNEATON
Carried out for LONDON MIDLAND REGION - BRITISH RAILWAYS BOARD.
Borehole No. 4 Diameter 6 INCHES
Ground Level 283.75 A.O.D. Scale 1/4 INCH TO 1 FOOT
M.O. 86.48

Description	M.C.	O.S.D.	Legend	Depth	Thickness	Sample	Water Levels
Made ground - Ashes.		283.7		0'0			
Made ground - clay, mudstone, shale and sandstone boulders.		282.2		11'6	1'6	X4'6-6'0 0'5'0	N = 10
Numerous hard sandstone boulders below 8'6					15'0	X8'0-9'0 0'6'0	N - no glass for Gins no further penetration.
						X12'0-13'6	N = 19
						0'15'0 X15'0-16'6 0'16'6	N = 11
Stiff red-brown clay.		267.2		16'6			16'4 (3-2-64)
					4'6	19'0 20'6	Met water 20'0
Fine greenish sand with some green clasts.		262.7		21'0		24'0 25'0	
					(10'0)		
						0'30'0	
		251.7		31'0			
						End of Bore	

DISCLOSED BY THE HIRE REGULATION LINE

SKETCH PLAN SHOWING BOREHOLE POSITIONS

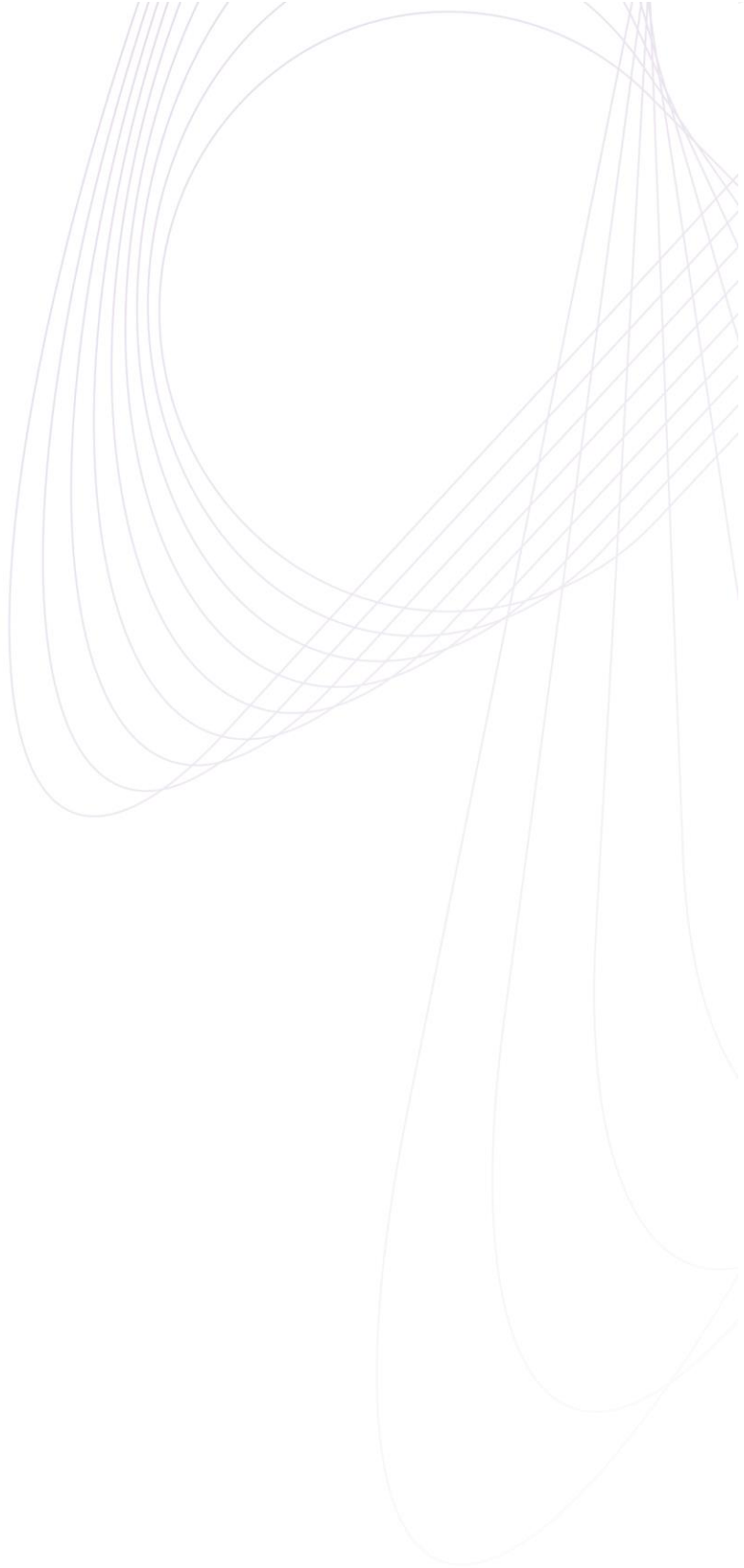


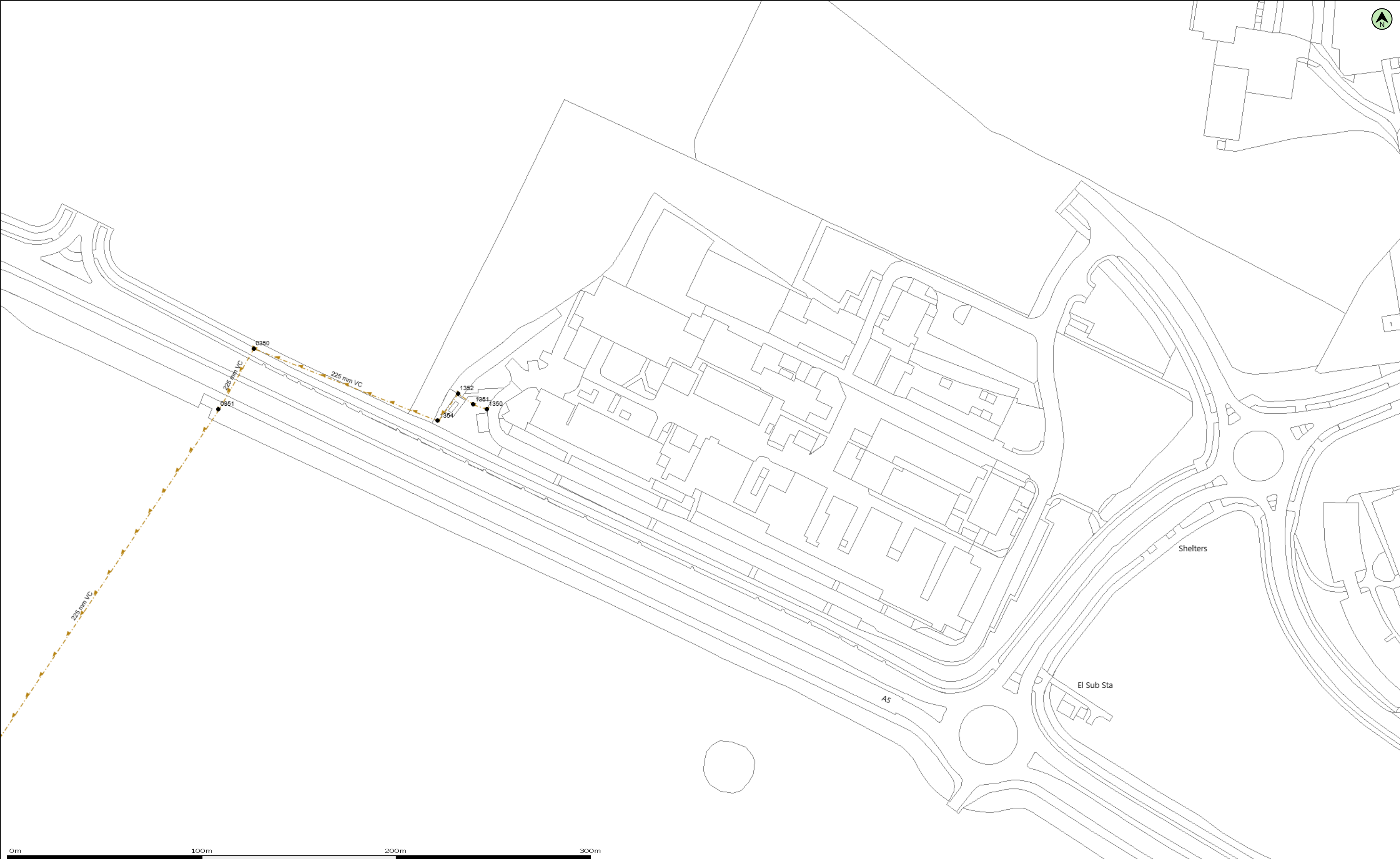
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Public Foul Gravity/Lateral Drain		Highway Drain	
Public Combined Gravity/Lateral Drain		Overflow Pipe	
Public Surface Water Gravity/Lateral Drain		Disposal Pipe	
Pressure Foul		Culverted Water Course	
Pressure Combined		Pumping Station	
Pressure Surface Water		Fitting	

Manhole Foul

Manhole Surface

Abandoned Pipe

Chamber

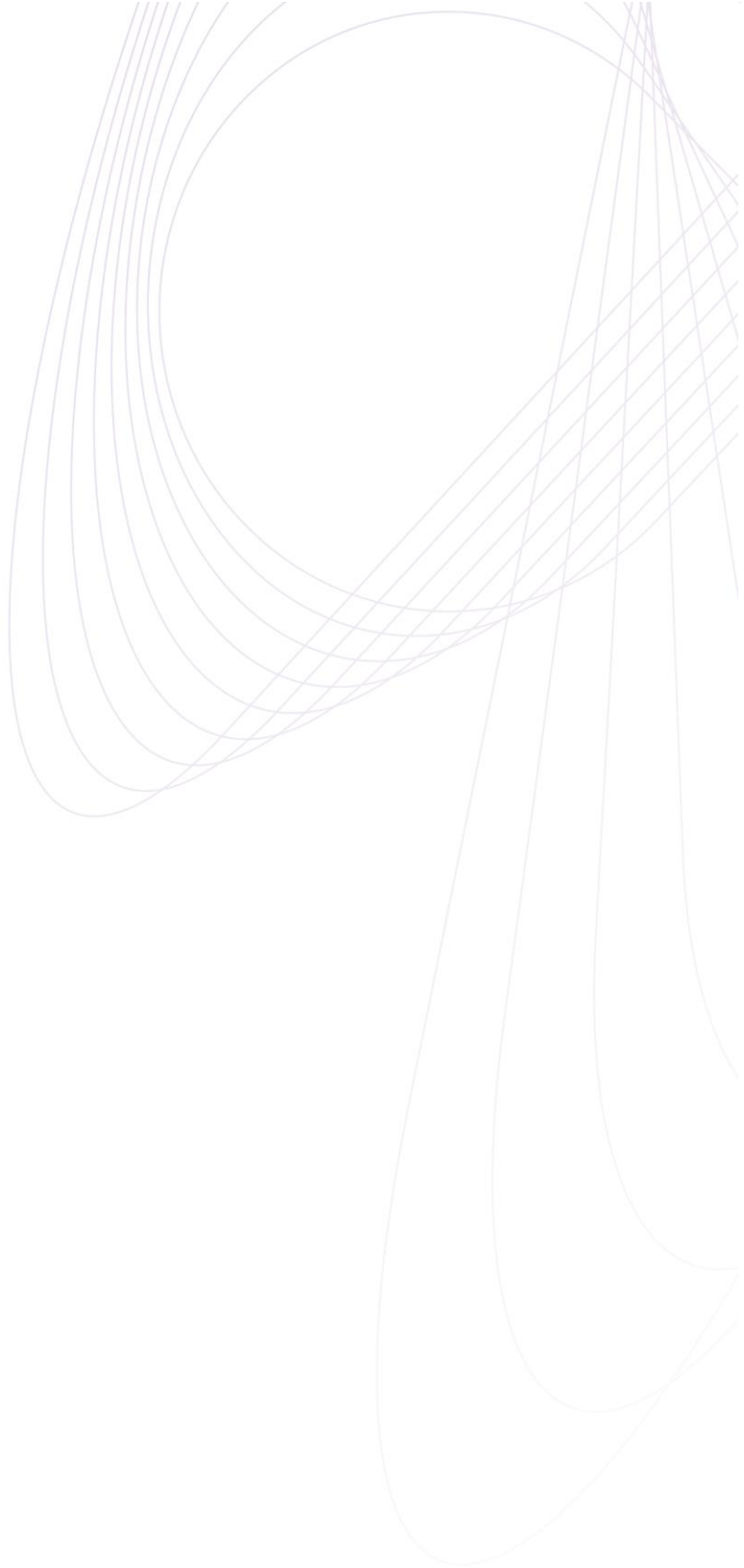
Section 104 sewers are shown in green

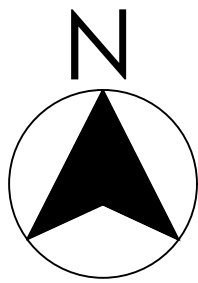
Private sewers are shown in magenta

bparmar@jmsengineers.co.uk
CO23/0129/03



Appendix D – Proposed Site Plan





DO NOT SCALE

HORIBA-MIRA Boundary

Proposed extension



No

Note

1. All dimensions in mm unless indicated.

Rev	By	Date	Description	Chk'd
Walling Street Nuneaton Warwickshire CV10 0TU England TEL +44 (0)24 7635 5000 FAX +44 (0)24 7635 8000 ESTATES MANAGEMENT © Copyright HORIBA-MIRA Ltd 2015				

Project:

HORIBA-MIRA
SITE PLAN

Drawing Title:

PROPOSED
FACILITY EXTENSION

Drawn

Chk'd

Appd

Status

Date

KC

MH

MH

Information

Jan 2023

Project No:

2023-001-FE

Scale @ A1

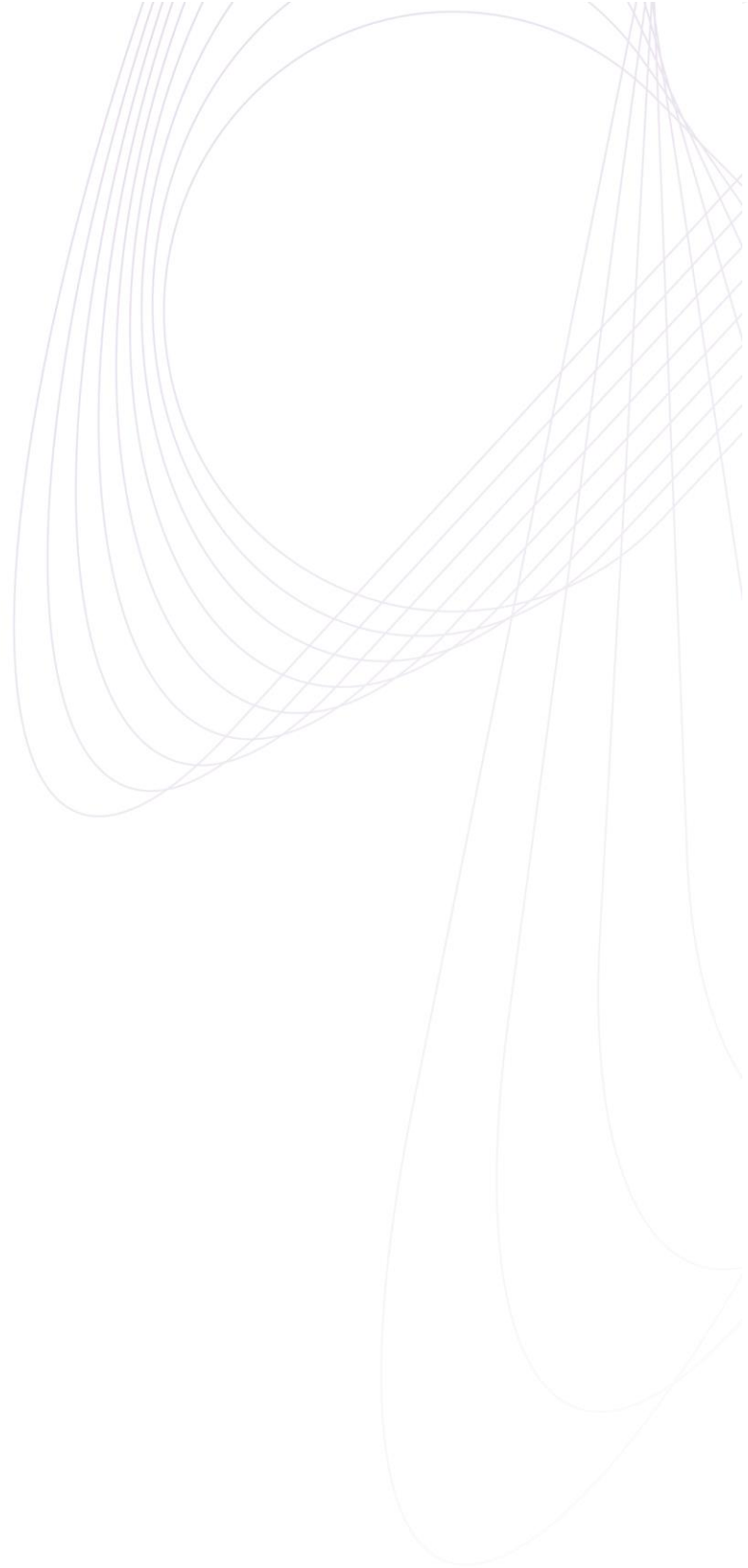
1:500

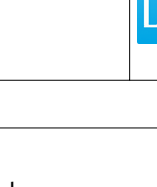
Drawing No:

2023-001-FE-SK-01

Rev

Appendix E – Microdrainage Calculations



JMS (Midlands) Ltd		Page 1
Victoria Count	HORIBA MIRA	
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Date 05/06/2023	Designed by BP	
File	Checked by	
XP Solutions	Network 2018.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.700	Add Flow / Climate Change (%)	0
Ratio R	0.405	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	22.200	0.230	96.5	0.024	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	24.800	0.250	99.2	0.024	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	36.000	0.360	100.0	0.023	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	13.000	0.090	144.4	0.024	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	3.100	0.080	38.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.36	84.400	0.024	0.0	0.0	0.0	1.02	18.1	3.2
1.001	50.00	5.77	84.170	0.048	0.0	0.0	0.0	1.01	17.8	6.5
2.000	50.00	5.60	84.660	0.023	0.0	0.0	0.0	1.00	17.8	3.1
1.002	50.00	6.03	83.920	0.095	0.0	0.0	0.0	0.83	14.7	12.9
1.003	50.00	6.06	83.830	0.095	0.0	0.0	0.0	1.62	28.7	12.9

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Victoria Count	HORIBA MIRA																																																																					
Tennant St Nuneaton	Workshop Extension																																																																					
Warwickshire CV11 4LZ	CO23/0129/02																																																																					
Date 05/06/2023	Designed by BP																																																																					
File	Checked by																																																																					
XP Solutions		Network 2018.1																																																																				
<u>Free Flowing Outfall Details for Storm</u> <table border="1"> <thead> <tr> <th>Outfall Pipe Number</th> <th>Outfall C. Level Name (m)</th> <th>I. Level (m)</th> <th>Min I. Level (m)</th> <th>D, L (mm)</th> <th>W (mm)</th> </tr> </thead> <tbody> <tr> <td>1.003</td> <td>85.000</td> <td>83.750</td> <td>0.000</td> <td>0</td> <td>0</td> </tr> </tbody> </table> <u>Simulation Criteria for Storm</u> <table border="1"> <tbody> <tr> <td>Volumetric Runoff Coeff</td> <td>0.750</td> <td>Additional Flow - % of Total Flow</td> <td>0.000</td> </tr> <tr> <td>Areal Reduction Factor</td> <td>1.000</td> <td>MADD Factor * 10m³/ha Storage</td> <td>2.000</td> </tr> <tr> <td>Hot Start (mins)</td> <td>0</td> <td>Inlet Coefficient</td> <td>0.800</td> </tr> <tr> <td>Hot Start Level (mm)</td> <td>0</td> <td>Flow per Person per Day (l/per/day)</td> <td>0.000</td> </tr> <tr> <td>Manhole Headloss Coeff (Global)</td> <td>0.500</td> <td>Run Time (mins)</td> <td>60</td> </tr> <tr> <td>Foul Sewage per hectare (l/s)</td> <td>0.000</td> <td>Output Interval (mins)</td> <td>1</td> </tr> <tr> <td>Number of Input Hydrographs</td> <td>0</td> <td>Number of Storage Structures</td> <td>1</td> </tr> <tr> <td>Number of Online Controls</td> <td>1</td> <td>Number of Time/Area Diagrams</td> <td>0</td> </tr> <tr> <td>Number of Offline Controls</td> <td>0</td> <td>Number of Real Time Controls</td> <td>0</td> </tr> </tbody> </table> <u>Synthetic Rainfall Details</u> <table border="1"> <tbody> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Profile Type</td> <td>Summer</td> </tr> <tr> <td>Return Period (years)</td> <td>2</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>19.700</td> <td>Storm Duration (mins)</td> <td>30</td> </tr> <tr> <td>Ratio R</td> <td>0.405</td> <td></td> <td></td> </tr> </tbody> </table>			Outfall Pipe Number	Outfall C. Level Name (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)	1.003	85.000	83.750	0.000	0	0	Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000	Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000	Hot Start (mins)	0	Inlet Coefficient	0.800	Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000	Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60	Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1	Number of Input Hydrographs	0	Number of Storage Structures	1	Number of Online Controls	1	Number of Time/Area Diagrams	0	Number of Offline Controls	0	Number of Real Time Controls	0	Rainfall Model	FSR	Profile Type	Summer	Return Period (years)	2	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	19.700	Storm Duration (mins)	30	Ratio R	0.405		
Outfall Pipe Number	Outfall C. Level Name (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)																																																																	
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Victoria Count Tennant St Nuneaton Warwickshire CV11 4LZ	HORIBA MIRA Workshop Extension CO23/0129/02	
Date 05/06/2023 File	Designed by BP Checked by	
XP Solutions	Network 2018.1	
Online Controls for Storm Orifice Manhole: 5, DS/PN: 1.003, Volume (m³): 1.5 Diameter (m) 0.049 Discharge Coefficient 0.600 Invert Level (m) 83.830		
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Victoria Count	HORIBA MIRA									
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Date 05/06/2023	Designed by BP									
File	Checked by									
XP Solutions	Network 2018.1									
<u>Storage Structures for Storm</u> <u>Tank or Pond Manhole: 4, DS/PN: 1.002</u> Invert Level (m) 83.920 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>3.7</td><td>1.000</td><td>73.5</td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	3.7	1.000	73.5
Depth (m)	Area (m²)	Depth (m)	Area (m²)							
0.000	3.7	1.000	73.5							
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Micro Drainage

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

Simulation Criteria

Areal Reduction Factor 1.000

Additional Flow - % of Total Flow 0.000

Hot Start (mins) 0

MADD Factor * 10m³/ha Storage 2.000

Hot Start Level (mm) 0

Inlet Coefficient 0.800

Manhole Headloss Coeff (Global) 0.500

Flow per Person per Day (l/per/day) 0.000

Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0

Number of Storage Structures 1

Number of Online Controls 1

Number of Time/Area Diagrams 0

Number of Offline Controls 0

Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR

Ratio R 0.408

Region England and Wales

Cv (Summer) 0.750

M5-60 (mm) 19.800

Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0

Analysis Timestep 2.5

Second Increment (Extended)

DTS Status OFF

DVD Status OFF

Inertia Status OFF

Profile(s) Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440

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

Climate Change (%) 0, 0, 40

US/MH

PN

Name

Storm

Return Period

Climate Change

First (X) Surcharge

First (Y) Flood

First (Z) Overflow

Overflow Act.

Water Level (m)

1.000

1

15 Winter

1

+0%

30/30 Winter

84.445

1.001

2

30 Winter

1

+0%

30/15 Summer

84.243

2.000

3

15 Winter

1

+0%

100/30 Winter

84.704

1.002

4

30 Winter

1

+0%

1/15 Summer

84.234

1.003

5

30 Winter

1

+0%

1/15 Summer

84.222

Surcharged

Flooded

Pipe

US/MH

PN

Name

Depth (m)

Volume (m³)

Flow / Cap.

Overflow (l/s)

Flow (l/s)

Status

Level Exceeded

1.000

1

-0.105

0.000

0.19

3.3

OK

1.001

2

-0.077

0.000

0.29

4.9

OK

2.000

3

-0.106

0.000

0.19

3.2

OK

1.002

4

0.164

0.000

0.24

3.2

SURCHARGED

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Date 05/06/2023			Designed by BP				
File			Checked by				
XP Solutions			Network 2018.1				

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

PN	US/MH Name	Surcharged Flooded		Flow / Cap.	Overflow (l/s)	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)			Flow (l/s)		
1.003	5	0.242	0.000	0.17		3.0	SURCHARGED	

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Workshop Extension

CO23/0129/02

Date 05/06/2023

File

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XP Solutions

Network 2018.1

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

Simulation Criteria

Areal Reduction Factor 1.000

Additional Flow - % of Total Flow 0.000

Hot Start (mins) 0

MADD Factor * 10m³/ha Storage 2.000

Hot Start Level (mm) 0

Inlet Coefficient 0.800

Manhole Headloss Coeff (Global) 0.500

Flow per Person per Day (l/per/day) 0.000

Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0

Number of Storage Structures 1

Number of Online Controls 1

Number of Time/Area Diagrams 0

Number of Offline Controls 0

Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR

Ratio R 0.408

Region England and Wales

Cv (Summer) 0.750

M5-60 (mm) 19.800

Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0

Analysis Timestep 2.5

Second Increment (Extended)

DTS Status OFF

DVD Status OFF

Inertia Status OFF

Profile(s) Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440

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

Climate Change (%) 0, 0, 40

US/MH

PN

Name

Storm

Return Period

Climate Change

First (X) Surcharge

First (Y) Flood

First (Z) Overflow

Overflow Act.

Water Level (m)

1.000

1

15 Winter

100

+40%

30/30 Winter

85.095

1.001

2

15 Winter

100

+40%

30/15 Summer

84.991

2.000

3

60 Winter

100

+40%

100/30 Winter

84.845

1.002

4

60 Winter

100

+40%

1/15 Summer

84.837

1.003

5

60 Winter

100

+40%

1/15 Summer

84.818

Surcharged

Flooded

Pipe

US/MH

PN

Name

Depth (m)

Volume (m³)

Flow / Cap.

Overflow (l/s)

Pipe Flow (l/s)

Status

Level Exceeded

1.000

1

0.545

0.000

0.68

11.7

SURCHARGED

1.001

2

0.671

0.000

1.29

21.9

SURCHARGED

2.000

3

0.035

0.000

0.43

7.4

SURCHARGED

1.002

4

0.767

0.000

0.37

5.0

FLOOD RISK

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Victoria Count	Lab Extension, MIRA																																																																																																																			
Tennant St Nuneaton	CO23/0129/02																																																																																																																			
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Date 26/04/2023	Designed by BP																																																																																																																			
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XP Solutions	Source Control 2018.1																																																																																																																			
Summary of Results for 100 year Return Period (+40%)																																																																																																																				
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4320 min Summer	83.956	0.056	1.5	0.3	O K																																																																																																															
5760 min Summer	83.949	0.049	1.2	0.2	O K																																																																																																															
7200 min Summer	83.944	0.044	1.0	0.2	O K																																																																																																															
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Winter	84.740	0.840	5.0	21.1	Flood Risk	30 min Winter	84.825	0.925	5.0	26.2	Flood Risk	60 min Winter	84.854	0.954	5.0	28.1	Flood Risk	120 min Winter	84.821	0.921	5.0	25.9	Flood Risk	180 min Winter	84.769	0.869	5.0	22.8	Flood Risk	240 min Winter	84.708	0.808	5.0	19.3	Flood Risk	360 min Winter	84.556	0.656	5.0	12.3	O K	480 min Winter	84.330	0.430	5.0	5.3	O K	600 min Winter	84.139	0.239	4.9	1.9	O K	720 min Winter	84.039	0.139	4.5	0.8	O K	960 min Winter	84.002	0.102	3.7	0.6	O K	1440 min Winter	83.979	0.079	2.6	0.4	O K	2160 min Winter	83.964	0.064	1.9	0.3	O K	2880 min Winter	83.956	0.056	1.5	0.3	O K	4320 min Winter	83.946	0.046	1.1	0.2	O K	5760 min Winter	83.941	0.041	0.9	0.2	O K	7200 min Winter	83.937	0.037	0.7	0.2	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	10080 min Summer	0.979	0.0	116.0	5096	15 min Winter	135.128	0.0	26.7	23	30 min Winter	88.754	0.0	35.0	35	60 min Winter	55.544	0.0	43.9	60	120 min Winter	33.591	0.0	53.0	96	180 min 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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.600	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.094

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To:	From:	To:	From:	To:
0	4 0.031	4	8 0.031	8	12 0.031

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Victoria Count	Lab Extension, MIRA	
Tennant St Nuneaton	CO23/0129/02	
Warwickshire CV11 4LZ		
Date 26/04/2023	Designed by BP	
File SOURCE CONTROL.SRCX	Checked by	
XP Solutions		Source Control 2018.1

Model Details

Storage is Online Cover Level (m) 84.900

Tank or Pond Structure

Invert Level (m) 83.900

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	4.0	1.000	73.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0105-5000-1000-5000
Design Head (m)	1.000
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	105
Invert Level (m)	83.900
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	5.0
Flush-Flo™	0.296	5.0
Kick-Flo®	0.637	4.1
Mean Flow over Head Range	-	4.3

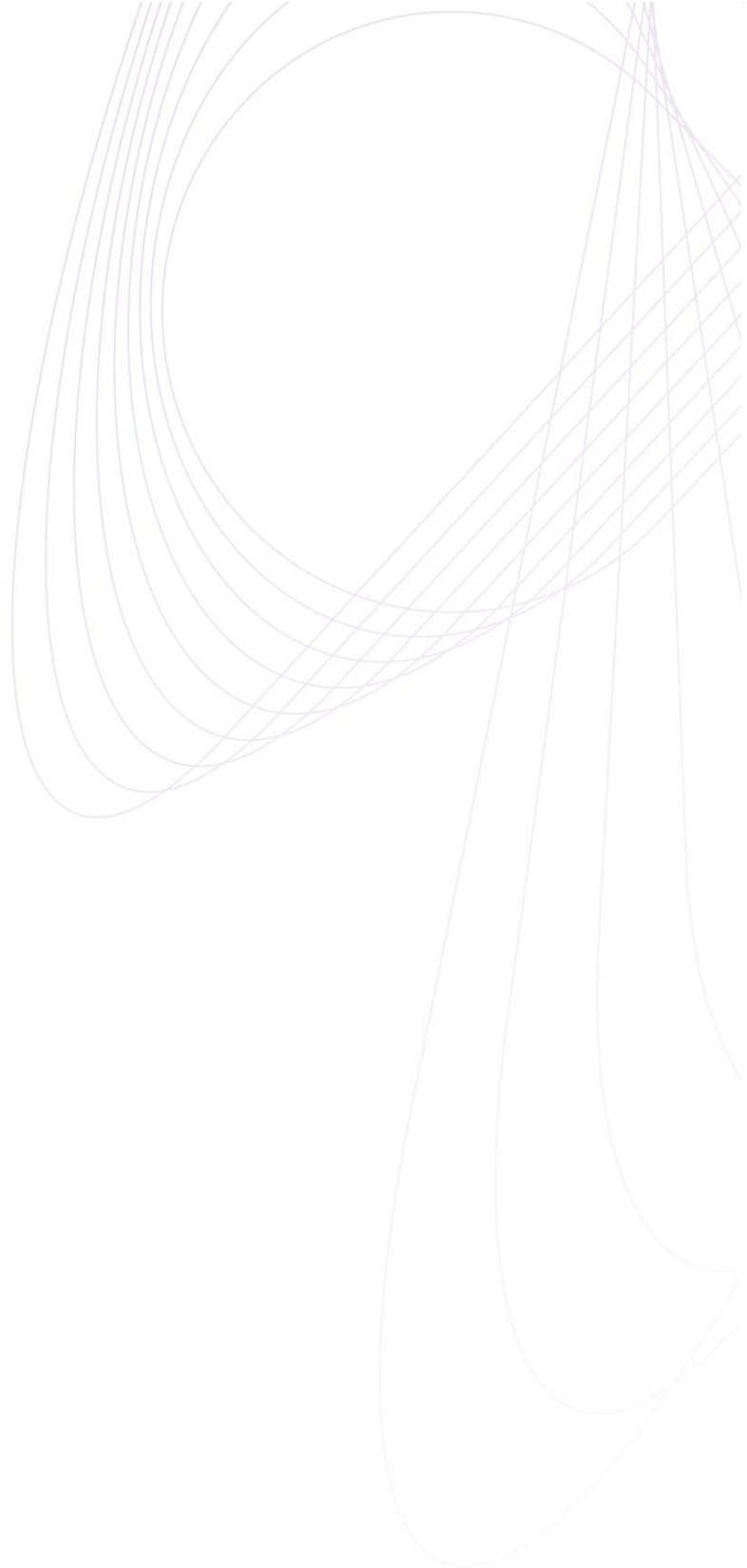
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

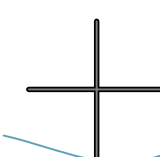
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.6	1.000	5.0	2.400	7.5	5.500	11.1
0.200	4.8	1.200	5.4	2.600	7.8	6.000	11.6
0.300	5.0	1.400	5.8	3.000	8.4	6.500	12.1
0.400	4.9	1.600	6.2	3.500	9.0	7.000	12.5
0.500	4.7	1.800	6.6	4.000	9.6	7.500	12.9
0.600	4.3	2.000	6.9	4.500	10.1	8.000	13.3
0.800	4.5	2.200	7.2	5.000	10.6	8.500	13.7

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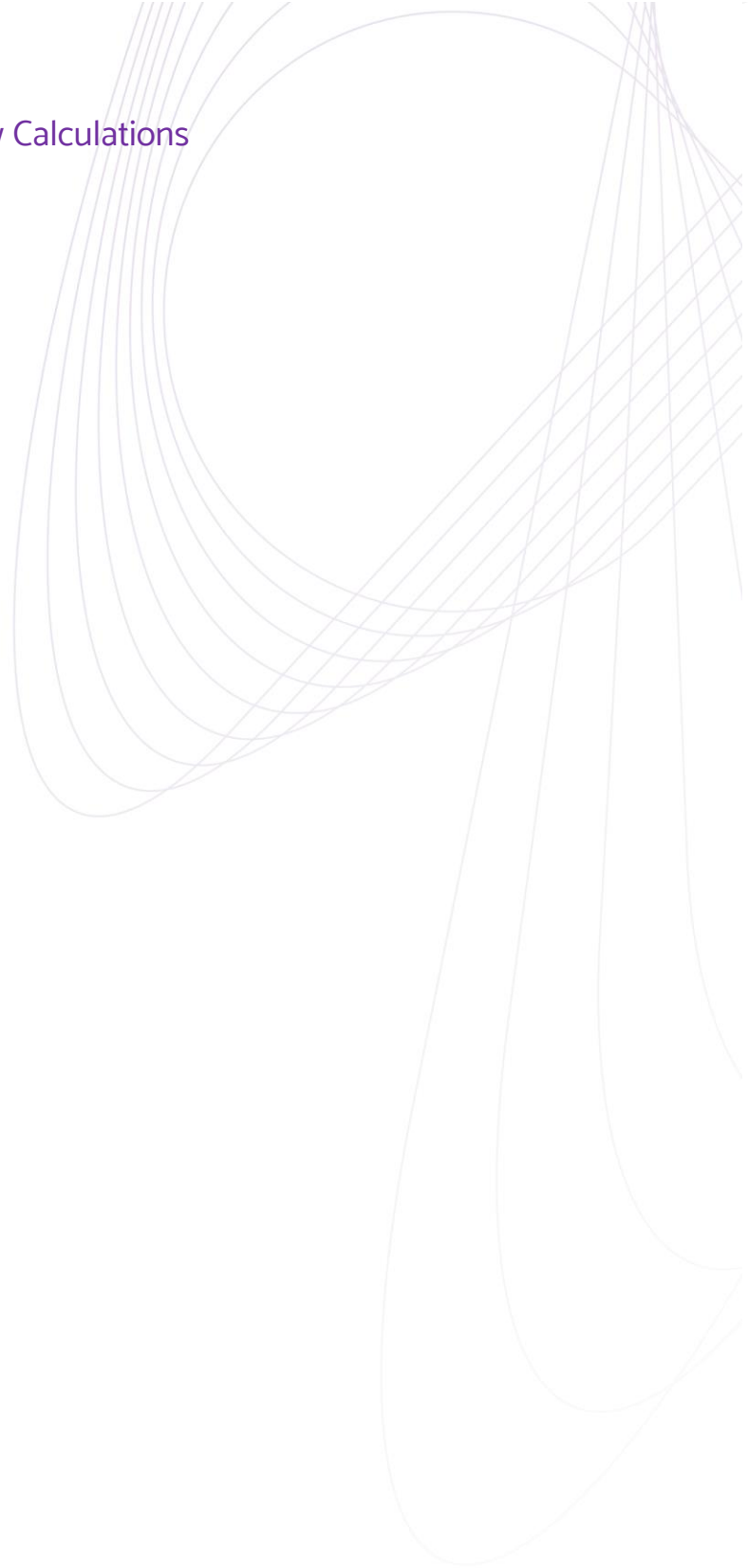
JMS (Midlands) Ltd		Page 6																
Victoria Count Tennant St Nuneaton Warwickshire CV11 4LZ	Lab Extension, MIRA CO23/0129/02																	
Date 26/04/2023 File SOURCE CONTROL.SRCX	Designed by BP Checked by																	
XP Solutions		Source Control 2018.1																
Hydro-Brake® Optimum Outflow Control <table><tr><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td></tr><tr><td>9.000</td><td>14.1</td><td>9.500</td><td>14.5</td><td></td><td></td><td></td><td></td></tr></table>			Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	9.000	14.1	9.500	14.5				
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)											
9.000	14.1	9.500	14.5															
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Appendix F –Drainage Strategy





Appendix G – Watercourse & Culvert Flow Calculations



	Channel		
	A	B	C
Manning's coefficient, n	0.04	0.04	0.04
Area, A	2.1	2.9	3.1
Wetted perimeter, P	4.2	4.8	5
Hydraulic Radius, R	0.50	0.60	0.62
Channel Slope, S	0.01	0.01	0.01
Q	4.3	6.5	7.8

	Box culvert
Manning's coefficient, n	0.013
Width, b	2
Height, h	1
Area, A	2
Wetted perimeter, P	6
Hydraulic Radius, R	0.33
Channel Slope, S	0.01
Q	9.48