



RIDGE

**JAGUAR LAND ROVER, HALEWOOD
BODY IN WHITE SOUTH EXTENSION**

**DRAINAGE TECHNICAL NOTE IN REPOSE TO LLFA
COMMENTS FOR PLANNING REF:22/00458/FUL**

OCTOBER 2022

Document Control Sheet

Project No: 5018966

Project Title: JLR, BIW South Extension, Halewood

Report Title: Drainage Technical Note in Response to LLFA Comments for Planning Ref: 22/00458/FUL

Report Reference: JLR-RDG-00-ZZ-RP-C-0001

Issue: 1

Status: Final

Date: 17.10.2022

Record of Issue

	Status	Author	Approved	Date
1	Final	Adam Matadar	Phil Barrett	17.10.22

Distribution

Issue	Organisation	Quantity
1	KC	1



Table of Contents

1.0 Introduction..... 1

2.0 LLFA Comments and Ridge Response 2

Appendix A – Ridge Design Drawings 1

Appendix B – Hydraulic Calculations 2

1.0 Introduction

In August 2022 a planning application was submitted to Knowsley Council for a proposed development that will facilitate the workings and construction of a new manufacturing facility (ref: 22/00458/FUL). The development is a two-storey manufacturing facility on the site south of the main facility. As part of the planning application, Ridge and Partners prepared a Drainage Technical note to support the Flood Risk Assessment (JLR-FRA-70091479) prepared by WSP. Having both documents, Knowsley Council LLFA provided comments and requested some additional information.

2.0 LLFA Comments and Ridge Response

Comments provided by the LLFA dated 29.09.2022 have been reviewed and the following response has been prepared below in **Table 1**:

Table 1: Ridge Response

LLFA Comments	Ridge Response
The existing drainage system has been surveyed but no explanation of its features, outfall(s) and how surface water is being managed have been provided. It would be required to demonstrate that which part of the existing drainage system (including network pipes and outfall(s)) will be remained, diverted, or demolished.	Additional plan has now been provided to show the existing private surface water drains and existing private foul water drains. The Existing Drainage and Proposed Abandonment plan and the Proposed Drainage GA plans have been included within Appendix A. Proposed Abandonment plan highlights the existing private SW drains that are to be abandoned as they are not in operation and are not taking any flows. The Proposed Drainage GA plan highlights the proposed diversion of the existing drains. These diversions are essential as parts of the existing drainage system are located underneath the proposed building footprint. It is not feasible to keep the existing drains in place due to possible damage from the proposed building foundations.
Evidence and justification that in selecting drainage features for post-development situation, the surface water drainage discharge hierarchy has been followed. Any drainage strategy proposal should clearly demonstrate how the movement down the hierarchy has been considered and that the selection of the most appropriate set of SuDS techniques has taken into account the site geological and topographical characteristics. To assess the feasibility of infiltration techniques as part of the proposed drainage strategy, evidence must be provided to show that a suitable number of soakaway tests have been completed across the whole site within different geology and to a suitable depth (i.e. a similar depth to the proposed infiltration devices). The tests should be completed according to the BRE 365 method and their results should be submitted with the full application. As part of infiltration tests, an assessment of groundwater levels and its fluctuations on the site will be required.	SuDS Hierarchal Approach has been considered for this scheme and had been explained in Drainage Technical Note 'JLR-RDG-00-ZZ-RP-C-0001'. Infiltration to Ground – No – According to the Ground Investigation report the site is underlain by made ground (up to 1.40m bgl) overlying firm sandy gravelly clay (up to 20m bgl), with groundwater recorded at depths ranging from 1.2m and 6.0m bgl. Due to the cohesive clay deposits which have low permeability and shallow groundwater levels, infiltration is not feasible at the site. Connection to Watercourse – No – An existing local watercourse is located approximately 700m east of the site boundary. Due to the proximity of the watercourse, this approach is not feasible. Connection to Surface Water Sewer – Yes – located at or near to the proposed development there are several private surface water drains. The existing site currently discharges into a private SW drain

	located north of the site. It is important to that all existing drainage infrastructure located within the vicinity of the site is private and no public sewers are in close proximity to the site. As such, an infrastructure based SW Drainage Strategy is considered feasible for the development, with run off from the hardstanding areas (courtyards and roof) directed to the new below ground infrastructure. Connection to Combined Water Sewer – No - Not feasible due to the private surface water sewer nearby.															
Should the proposed discharge destination to the public sewer system is retained in the final design, the proposed maximum discharge rate of 21l/s would be acceptable.	The SW from the development is proposed to discharge into the existing Private SW Drain located northeast of the site at maximum rate of 21l/s. It is important to note that there no public sewers in close proximity to the site.															
Should the proposed discharge destination to the public sewer system is retained in the final design, the Untitled Utilities’ agreement on the connection point(s) will be required.	The SW from the proposed development is to discharge into a private SW drain located north east of the site. Therefore an agreement with United Utilities is not required.															
Should there is any public sewer diversion is proposed, the agreement of the asset owner will be required.	No public sewer within the site vicinity therefore no public sewer diversions are proposed.															
No evidence of water quality assessment has been submitted. Water quality should be taken into account as part of the proposed drainage design. It will be required to demonstrate that adequate water quality of the off-site surface water flows (draining into a sewer, watercourse and ground) in accordance with the Simplified Index Approach as set out within Section 26 of the SUDS Manual (C753) can be achieved. From the development description it is not clear that whether or the proposed development include an individual yard or a parling area with heavy vehicles traffics. If this is the case, water quality risk to groundwater should be assessed (screening risk) and mitigation measures to be adopted to ensure that risk to groundwater are effectively managed (see Table 26.1 and Sections 26.7.1 and 26.7.2 of the SUDS Manual).	CIRIA 753 SuDS guidance identifies the pollution hazard level from the proposed development to be ‘low’. See the extract below from CIRIA SuDS 753 Manual. <table><tr><th colspan="5">Pollution hazard indices for different land use classifications</th></tr><tr><th>Land use</th><th>Pollution hazard level</th><th>Total suspended solids (TSS)</th><th>Metals</th><th>Hydrocarbons</th></tr><tr><td>Other roofs (typically commercial/ industrial roofs)</td><td>Low</td><td>0.3</td><td>0.2 (up to 0.8 where there is potential for metals to leach from the roof)</td><td>0.05</td></tr></table> The proposed development will have SW runoff from the roof and surrounding hardstanding areas. There are no parking areas and heavy vehicle traffic areas proposed. Therefore, to improve the water quality from the proposed development, the proposed drainage strategy has implemented numerous catchpit manholes and drainage channels with silt traps to mitigate the Total Suspended Solids (TSS). This measure allows to catch sediments and debris that gets carried away along the SW system and reduces the possibility of blockages occurring.	Pollution hazard indices for different land use classifications					Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons	Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Pollution hazard indices for different land use classifications																
Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons												
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05												

	The proposed roof is to have a semi-gloss paint finish with no metal cladding being exposed. As such, pollution from metals is very low to non-existent. Therefore, no SuDS measures are to be implemented for pollution from Metals. Hydrocarbons for the proposed development is non-existent as there are no proposed car parking areas discharging into the proposed SW system. Therefore, no SuDS measures are to be implemented for pollution from Hydrocarbons.
Exceedance routes of surface water should be provided for the post development situation. It is recommended that based on the exceedance routes and flow depth produced, finished floor levels for proposed building, access roads and car parking to be set. A 1 in 200 years plus 40% event would normally be considered as the exceedance event. It is expected that manholes surcharged during such an event to be identified, and volume and maximum depth of flood water and where the flood water pools or flows to be determined.	The Flood Exceedance Plan provided has been updated to the LLFA comments, this plan is attached within the Appendix A. The updated Flood Exceedance Plan now shows the Flood Volume up to the 1 in 200 year plus 40% CC storm event. Arrows have been shown on the plan to indicate the flow route for flood exceedance runoff. It is anticipated that the SW flow route is to stay within the private highway in between the kerbs. The topography indicates the private highway levels falling from the south east to the north east. Also, a copy of the hydraulic results for the Flood Exceedance has been attached within Appendix B.
An evaluation of impact of potential failure of the drainage system should be provided. The risk assessment should include for blockage of pipes, blockage of outlet structures and risk of impediments across planned flood routing paths. The drainage design should be supported by a designer's risk assessment that identifies key points of failure of the system and what means have been considered to limit risk of failure. This will also inform the maintenance plan with regards to corrective actions needed should a failure occurs.	A Designers Risk Assessment has been attached within Appendix A.
Construction details of the proposed drainage features (e.g. attenuation tanks, manholes and oil separator) will be required. A demonstration of construction integrity of the proposed SUDS features (e.g. attenuation tank and oil separator) given heavy vehicles traffics and manoeuvring will also be required.	Proposed Drainage Details have been attached within Appendix A.

A timetable for implementation of the drainage works including an assessment of any phasing of the development if applies.	This is to be confirmed and provided once a contractor has been assigned.
An updated detailed drainage scheme plan will be required in compliance with the above points. The Plan will be required showing the layout of the proposed drainage network, post development impermeable area, post development catchment areas to each SUD feature, SUDs features adopted for interception of first 5mm of rainfalls, the location of the storage within the proposed development, connection points and how these relate to the submitted calculations, including any chamber, pipe numbers, direction of flow, invert and cover levels, gradients diameters, dimensions finished floor levels and access road levels.	The Proposed Drainage GA plan, Manhole Schedule, Existing and Proposed Impermeable Area Plans, Flood Exceedance Plan and A Drainage Maintenance Schedule have been updated. These plans are attached within Appendix A. SuD's features such as silt traps and catchpit manholes have been updated and noted on the Manhole Schedule. Drainage Channels and Siphonic Drainage have been implemented into the drainage design to intercept the rainfall on the roof and hardstanding footway areas. It is important to note that the existing car park SW regime is to remain as is, where currently series of channel drainage intercept the rainfall and the SW is discharged west of the site. No works are proposed for the existing car park area.
No Management and Maintenance Plan has been submitted. A Management and Maintenance Plan relating to the lifetime of the sustainable drainage system through an appropriate legally binding agreement shall be submitted to and approved in writing by the Local Planning Authority.	A Drainage Maintenance Schedule has now been provided for this scheme and is attached within the Appendix A.

Appendix A – Ridge Design Drawings

CONTENTS	
Identifier	Name
HAS-RDG-ZZ-ZZ-DR-C-0501	Proposed Drainage GA Sheet 1
HSA-RDG-ZZ-ZZ-DR-C-0502	Proposed Drainage GA Sheet 2
HSA-RDG-ZZ-ZZ-SC-C-0503	Manhole Schedule
HSA-RDG-ZZ-ZZ-DR-C-0504	Proposed Impermeable Areas
HSA-RDG-ZZ-ZZ-DR-C-0505	Flood Exceedance Plan
HSA-RDG-ZZ-ZZ-DR-C-0510	Existing Drainage and Proposed Abandonment Plan
HSA-RDG-ZZ-ZZ-DR-C-0506-0509	Drainage Details (4 Sheets)

REQUIRED INVESTIGATIONS

CONFIRM THE EXISTING SURFACE WATER DRAINS FLOWING WEST UNDERNEATH THE PROPOSED BUILDING ARE REDUNDANT.

INFILTRATION TESTING WITHIN THE SITE TO CONFIRM A SOAKAWAY OPTION IS VIABLE OR NOT.

PROPOSED RUNOFF RATE BASED UPON 50% BETTERMENT OF THE EXISTING RUNOFF RATES - IN LINE WITH THE KNOWSLEY SFRA 2012.

PROPOSED RUNOFF RATE OF 21l/s IS YET TO BE AGREED WITH KNOWSLEY COUNCIL (LLFA).

PROPOSED SW ATTENUATION BASED UPON IMPERMEABLE AREA OF 1.9ha - SEE DRAWING 5017026-RDG-ZZ-ZZ-DR-C-0002 - Proposed Impermeable Areas

EXISTING SERVICES UNDERNEATH THE PROPOSED BUILDING TO BE REMOVED OR DIVERTED. TBC AT THE APPROPRIATE STAGE.

ALL EXISTING DRAINAGE INFRASTRUCTURE UNDERNEATH THE PROPOSED BUILDING TO BE REMOVED / GRUBBED OUT UNLESS NOTED OTEHRWISE.

ALL PROPOSED DRAINAGE INFRASTRUCTURE TO BE PRIVATE.

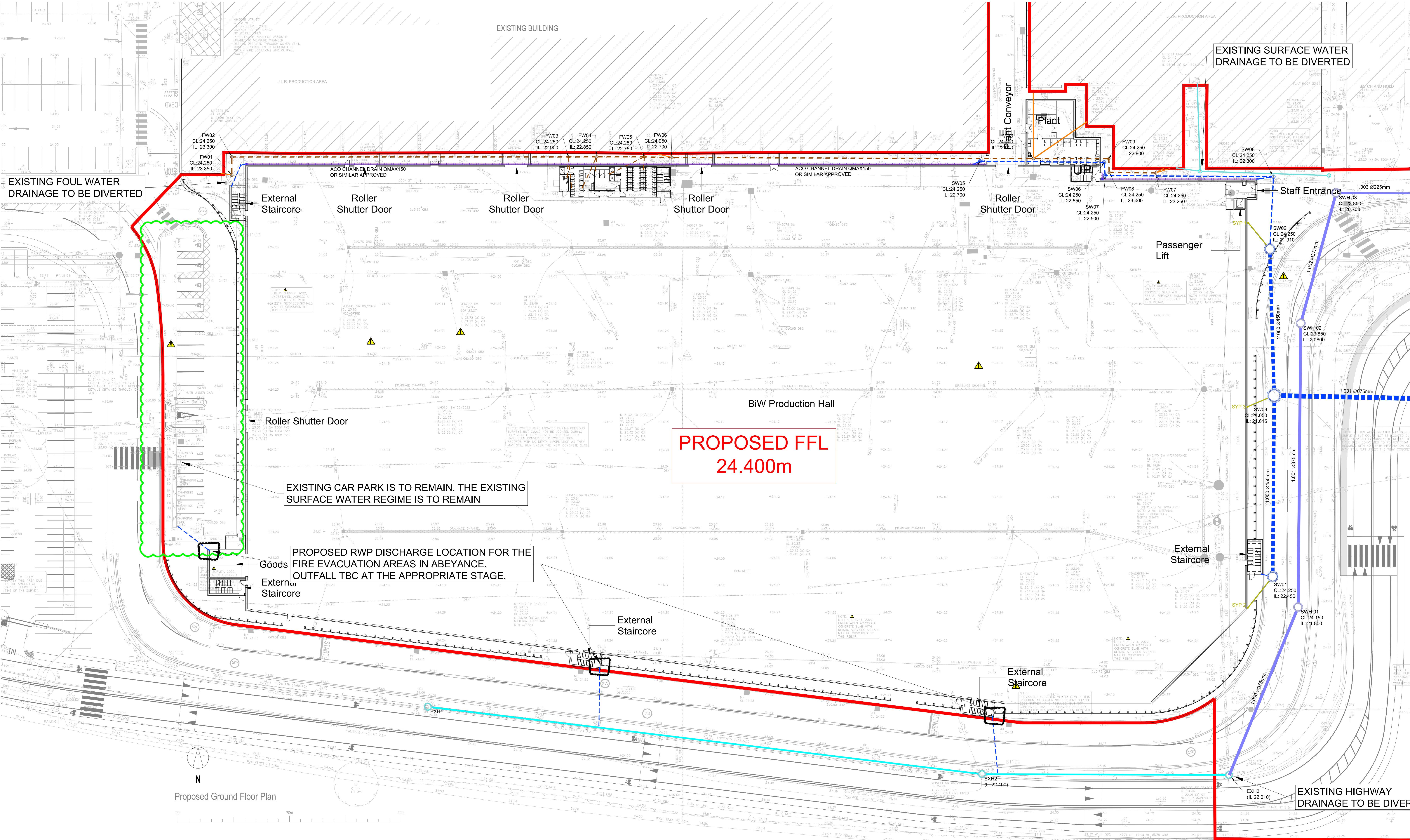
ALL RWP DROP LOCATIONS AND SYPHONIC DRAINAGE TO BE CONFIRMED BY OTHERS.

ALL CONNECTIONS TO HAVE ABOVE GROUND RODDABLE ACCESS.

REFER TO RDG DRAWING '5018966-RDG-ZZ-ZZ-DR-C-0510 - Existing Drainage Abandonment Plan' FOR THE EXISTING DRAINAGE LAYOUT AND PROPOSED ABANDONED DRAINS.

DRAINAGE KEY

- PROPOSED FW SEWER
- PROPOSED FW MANHOLE
- PROPOSED SW SEWER
- PROPOSED SW MANHOLE
- PROPOSED HIGHWAY DRAINAGE DIVERSION
- EXISTING HIGHWAY DRAIN
- PROPOSED FW DIVERSION
- PROPOSED SIPHONIC DRAIN
- PROPOSED CHANNEL DRAIN



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PGS	CATCHMENT MANHOLES ADDED	17.10.22	AM	AM
PG4	ADDITIONAL RAPS ADDED FOR THE FIRE ESCAPE ZONES	22.08.22	AP	AM
PG3	AMENDED AFTER COMMENT	22.08.22	AP	AM
PG2	REDLINE BOUNDARY AND THE PROPOSED SW TANK LOCATION UPDATED	15.08.22	AM	AM
PG1	PRELIMINARY ISSUE	08.08.22	AP	AM
REV	DESCRIPTION	DATE	BY	CHKD
ORIGINATOR:				

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BELLEVUE HOUSE
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CLIENT:
JAGUAR LAND ROVER

IN ASSOCIATION WITH:

PROJECT:
South Apron BIW BUILDING

TITLE:
PROPOSED DRAINAGE GA
SHEET 1 OF 2

ENG/TECH: CSE: AM ICSE: AM SCALE: 1:250 @ A1
STATUS: PRELIMINARY

*UNLESS ISSUED FOR CONSTRUCTION - WORKS AT CLIENT/CONTRACTORS RISK**

SUITABILITY: 03 - Issued for Internal Review and Comment

PROJECT: HSA ORG: RDG ZONE: XX TYPE: DR ROLE: C NUMBER: 0501 REV: P05

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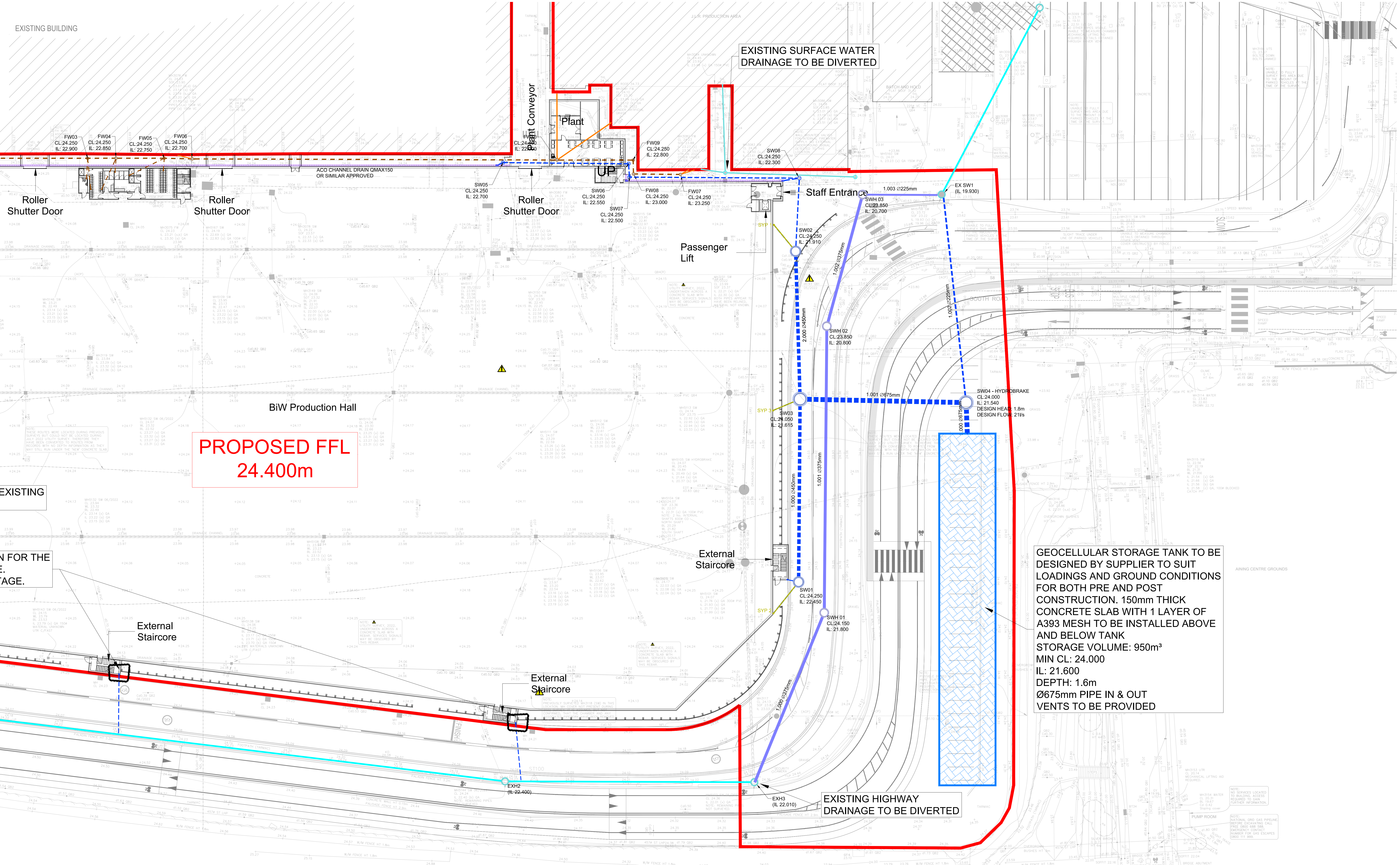
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R05	CATCHMENT MANHOLES ADDED	17.10.22	AM	AM
R04	ADDITIONAL RAPS ADDED FOR THE FIRE ESCAPE ZONES	22.09.22	AP	AM
R03	AMENDED AFTER COMMENT	22.09.22	AP	AM
R02	REDLINE BOUNDARY AND THE PROPOSED SW TANK	15.09.22	AM	AM
R01	LOCATION UPDATED	15.09.22	AM	AM
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REV	DESCRIPTION	DATE	BY	CHKD

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PROPOSED DRAINAGE GA
SHEET 2 OF 2

ENG/TECH:	CSE:	ICSE:	SCALE:	1:250	1/1
AP	AM	AM	STATUS ISSUE:	7	

STATUS:
PRELIMINARY

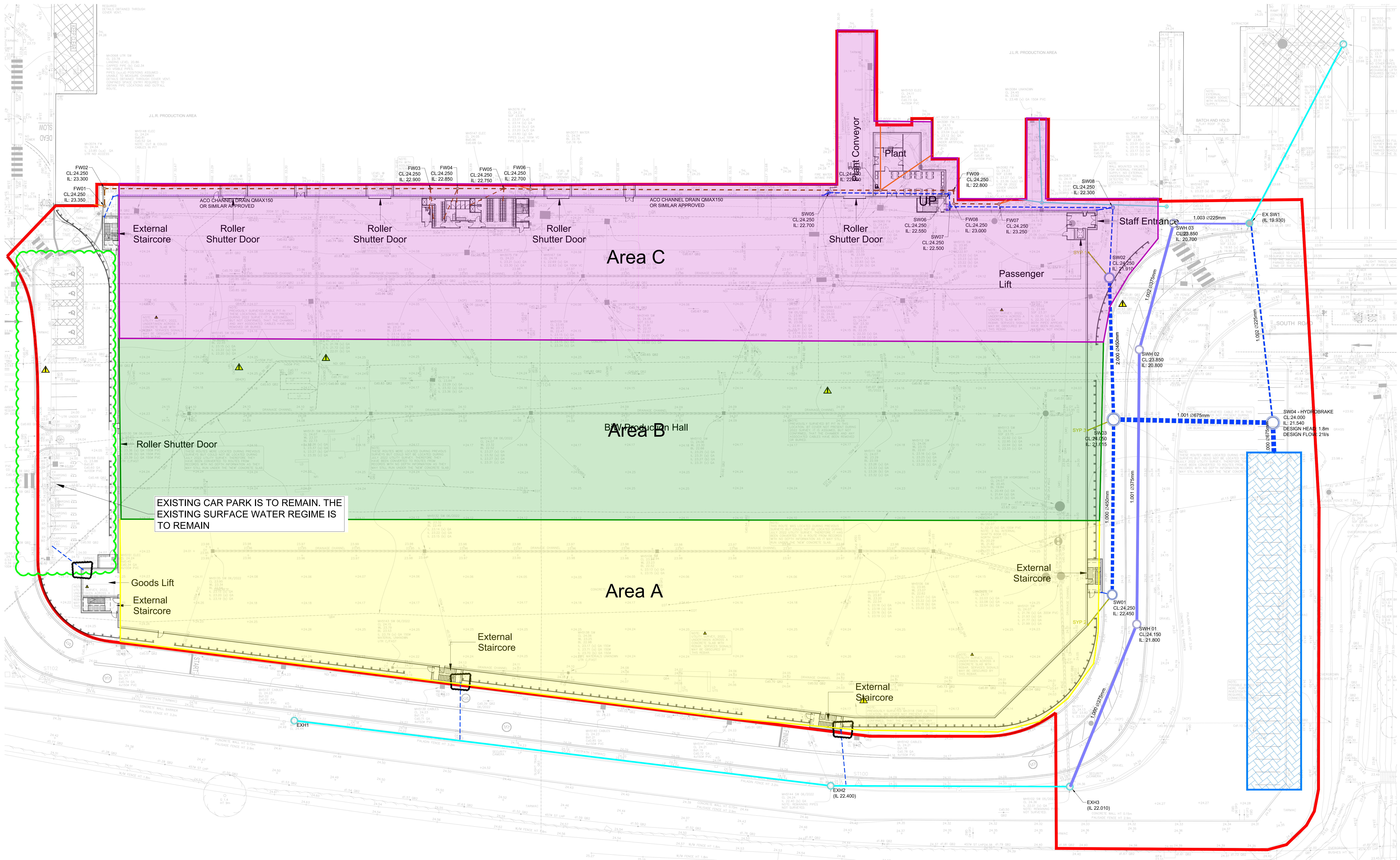
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PROJECT:	ORG:	ZONE/LEVEL:	TYPE:	ROLE:	NUMBER:	REV:
HSA	RDG	XX XX	DR	C	0502	P05

Catchment Area:

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Area B	0.605	1.001
Area C	0.575	2.000
Total	1.770	



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P03	UPDATED TO SUIT THE LATEST MASTERPLAN	17.10.22	AM	AM
P02	RED LINE BOUNDARY AND SW TANK LOCATION UPDATED	15.09.22	AM	AM
P01	PRELIMINARY ISSUE	08.09.22	AP	AM
REV	DESCRIPTION	DATE	BY	CHKD

ORIGINATOR:

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PROJECT:
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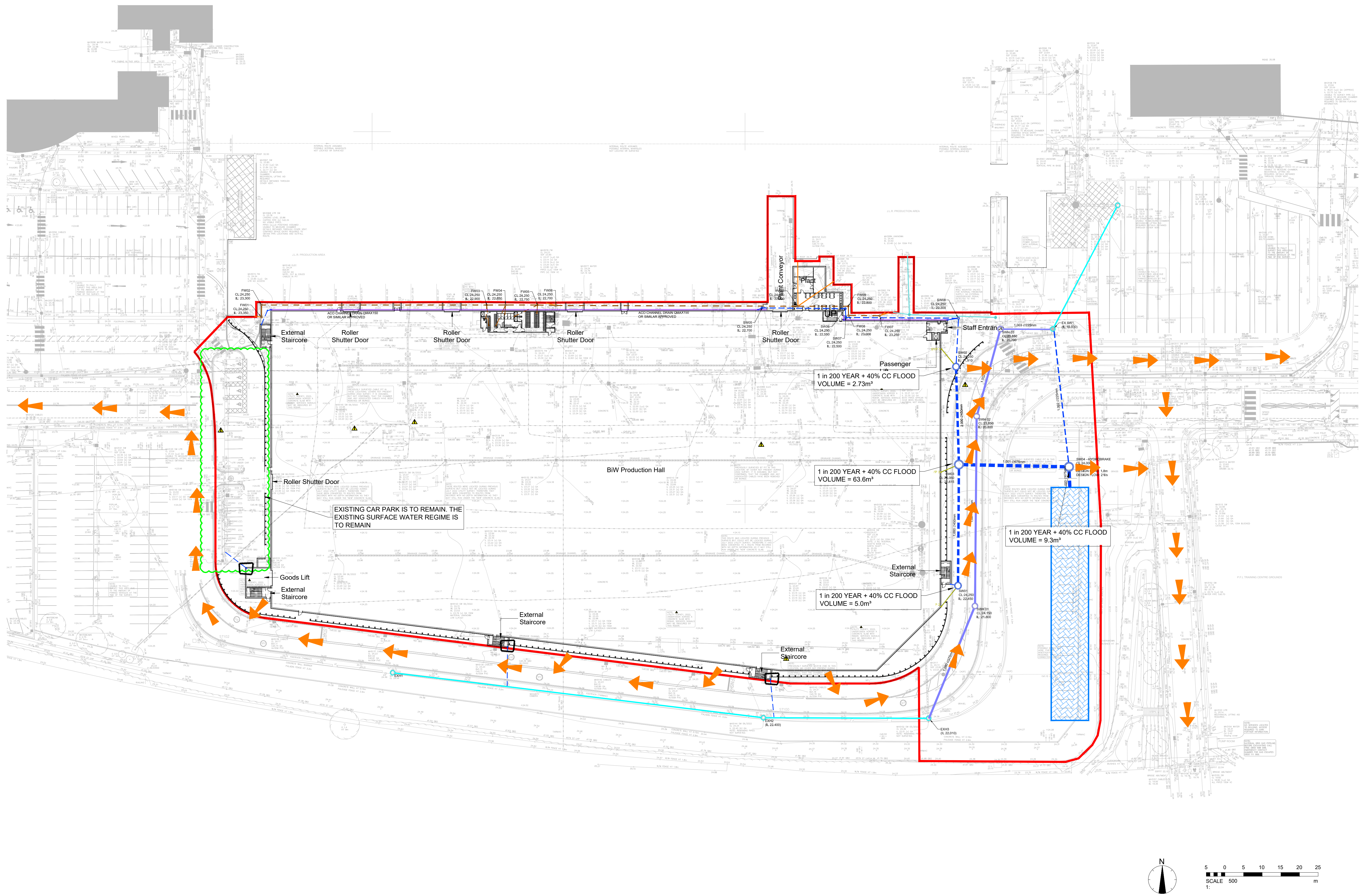
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PROPOSED IMPERMEABLE AREAS

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AP	AM	AM	STATUS ISSUE:	7	

STATUS:
PRELIMINARY

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SUITABILITY:	IS - Initial Status or VPP					
PROJECT:	ORG:	ZONE/LEVEL:	TYPE:	ROLE:	NUMBER:	REV:
5018966	RDG	XX	XX	DR	C	0504 P03



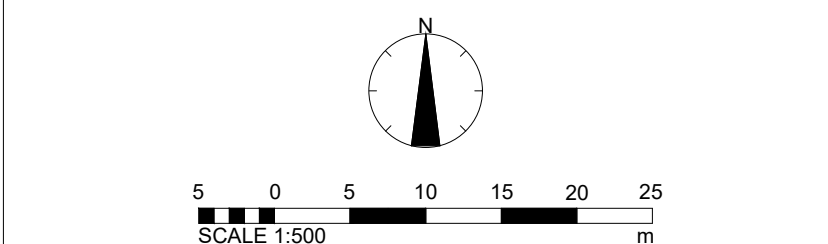
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- EXISTING HIGHWAY DRAIN
- PROPOSED FW DIVERSION
- PROPOSED SIPHONIC DRAIN
- EXCEEDANCE FLOOD ROUTE (FLOOD EVENTS > 100yr + 45% CC)

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P03	EXCEEDANCE FLOOD ROUTE AND FLOOD VOLUME	17.10.22	AM	AM
P02	RED LINE BOUNDARY AND SW TANK LOCATION UPDATED	15.09.22	AM	AM
P01	PRELIMINARY ISSUE	08.09.22	AP	AM
REV	DESCRIPTION	DATE	BY	CHKD

ORIGINATOR:



THE COWYARDS
BLENNHEIM PARK
OXFORD ROAD
WOODSTOCK, OX20 1GR

TEL: 01993 819000

WWW.RIDGE.CO.UK

CLIENT:
JAGUAR LAND ROVER

IN ASSOCIATION
WITH:

PROJECT:
BIW SOUTH EXTENSION

TITLE:
FLOOD EXCEEDANCE PLAN

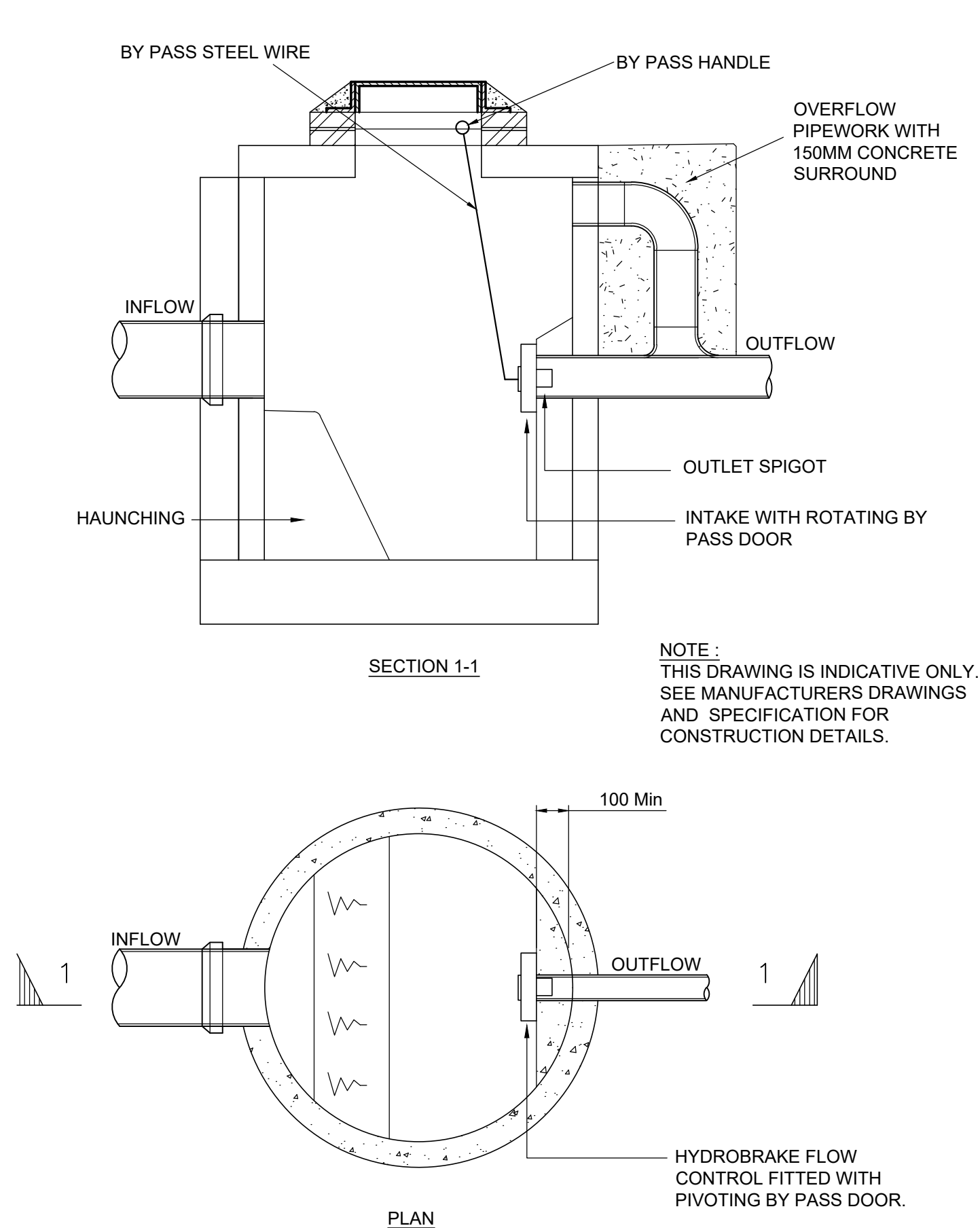
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AP	AM	AM	STATUS ISSUE:	7	

STATUS:
PRELIMINARY

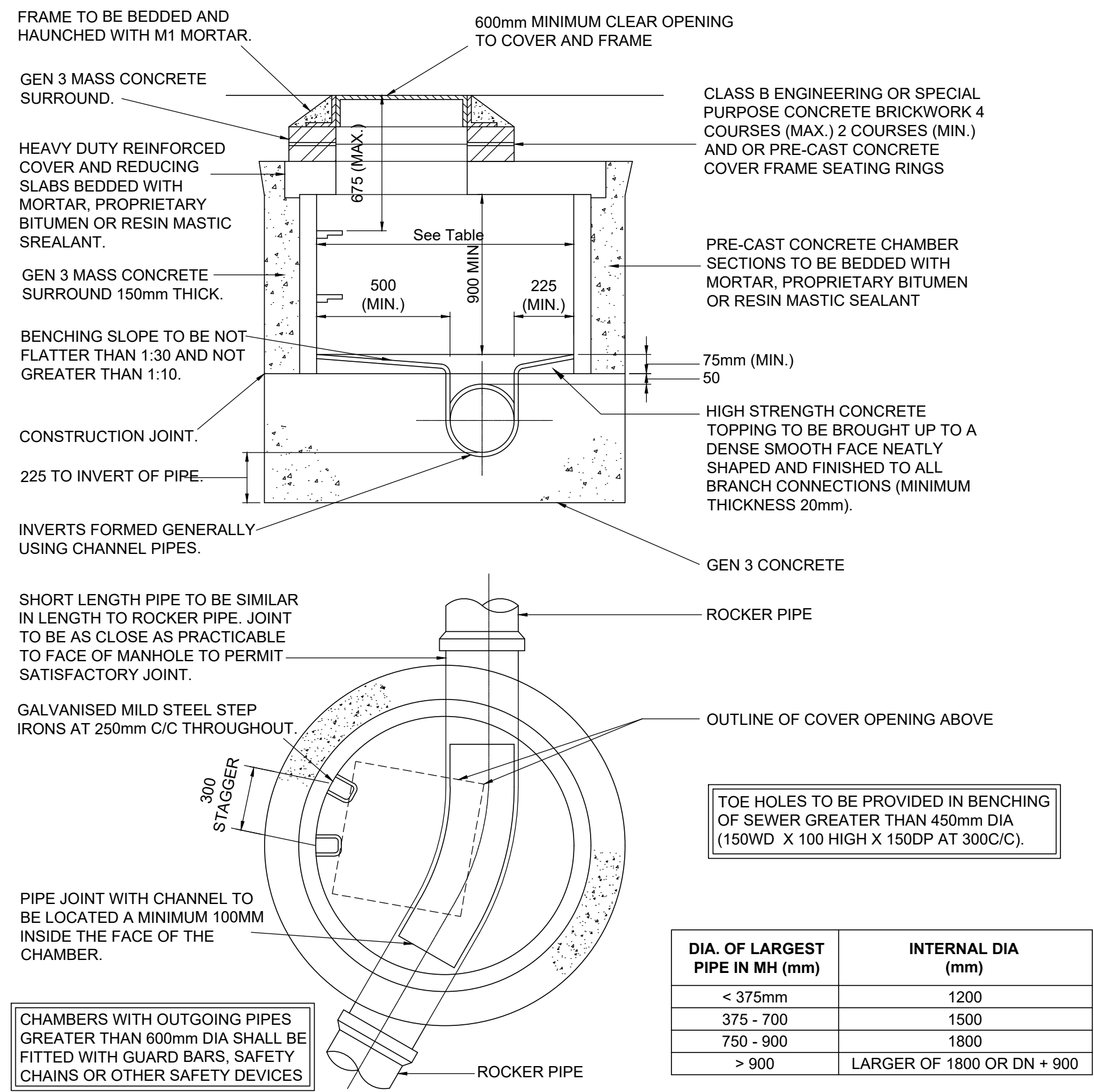
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SUITABILITY:
SS - Initial Status or VPP

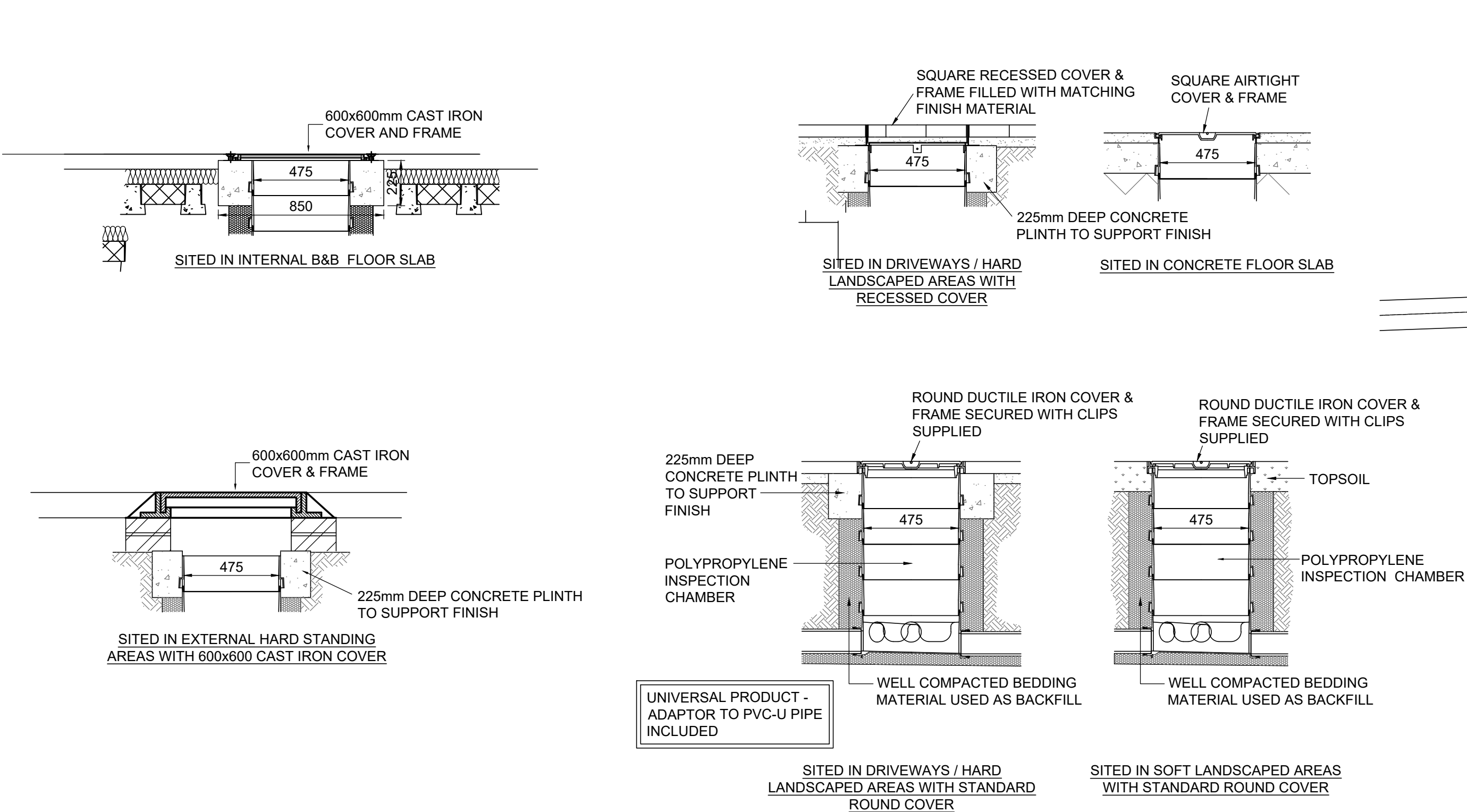
PROJECT: 5018966 RDG XX XX DR C 0505 P03



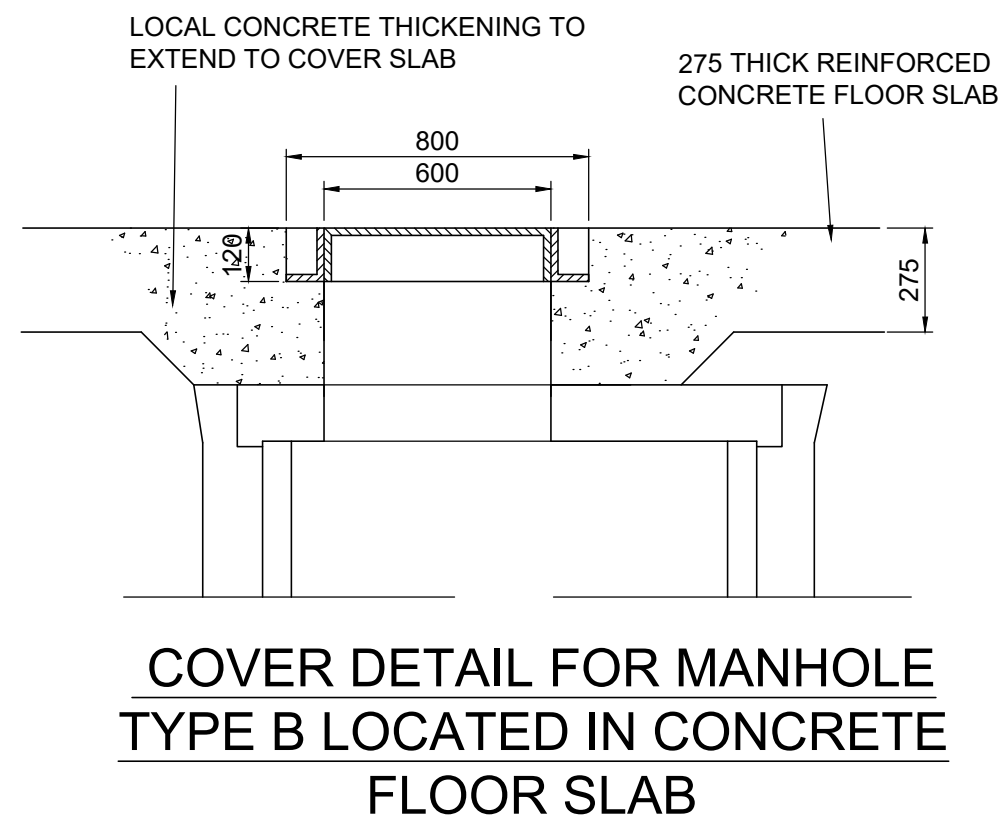
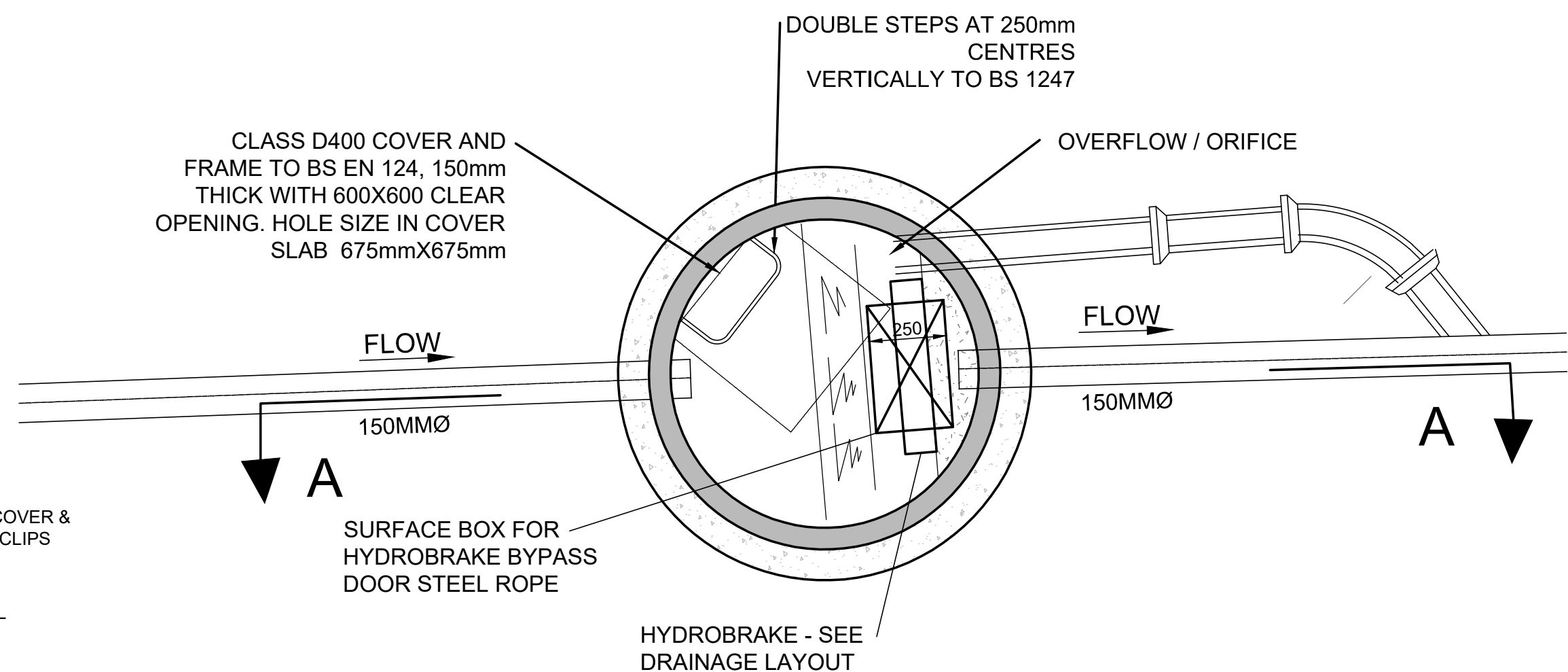
VORTEX CONTROL CHAMBER



MANHOLE TYPE B



POLYPROPYLENE INSPECTION CHAMBER INSTALLATION DETAIL



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P02	UPDATED TITLE BLOCK	30.09.22	AP	AM
P01	PRELIMINARY ISSUE	22.09.22	AD	AM
REV	DESCRIPTION	DATE	BY	CHKD



5TH FLOOR
BELVEDERE HOUSE
12 BOOTH STREET
MANCHESTER, M2 4AW

TEL: 0161 833 9579
WWW.RIDGE.CO.UK

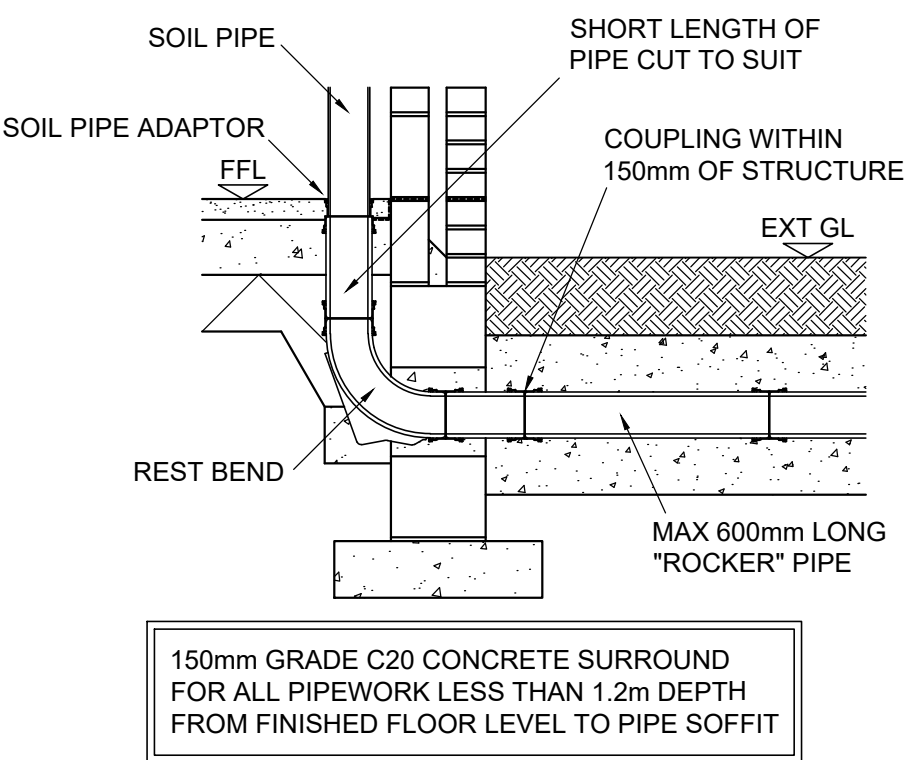
CLIENT:
JAGUAR LAND ROVER

IN ASSOCIATION WITH:

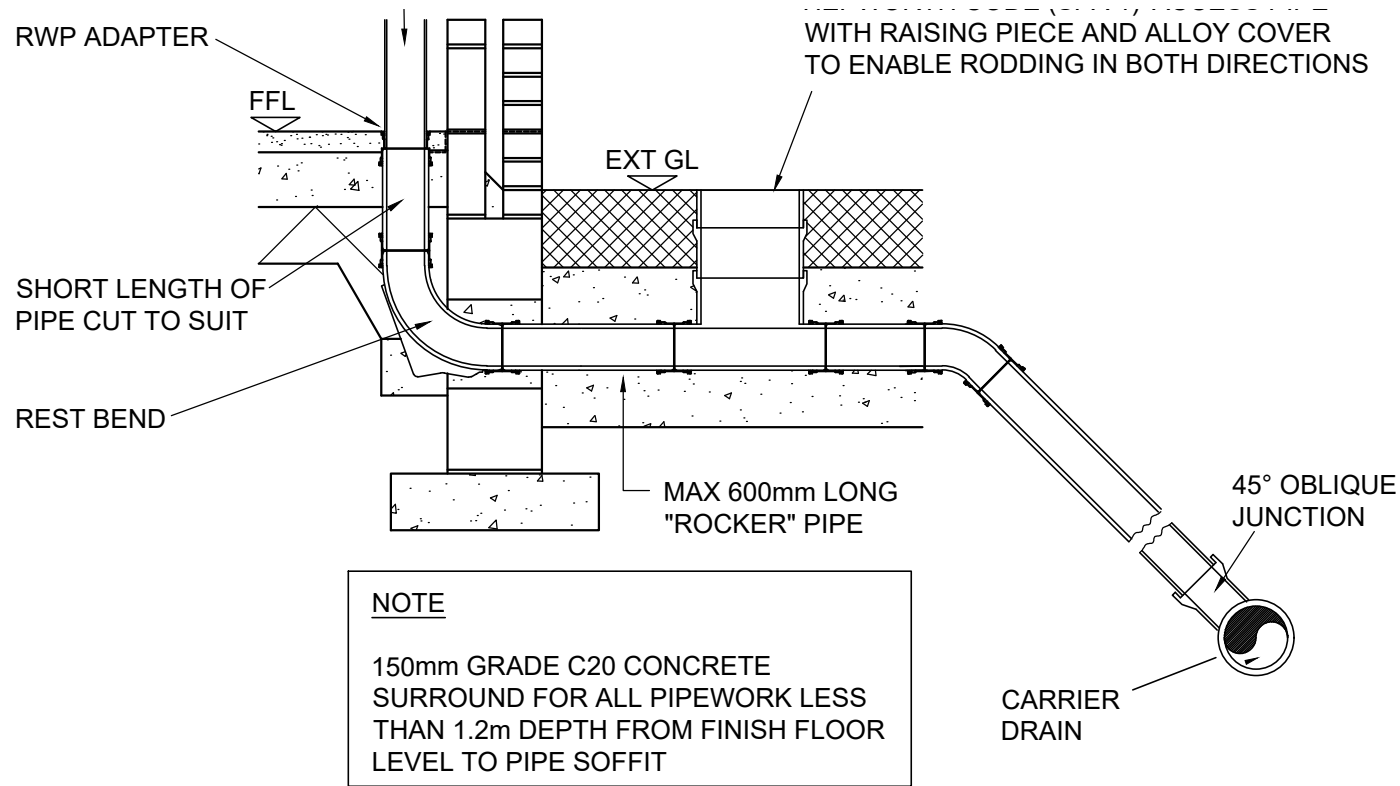
PROJECT:
South Apron BIW BUILDING

TITLE:
PROPOSED DRAINAGE DETAILS
SHEET 1 OF 4

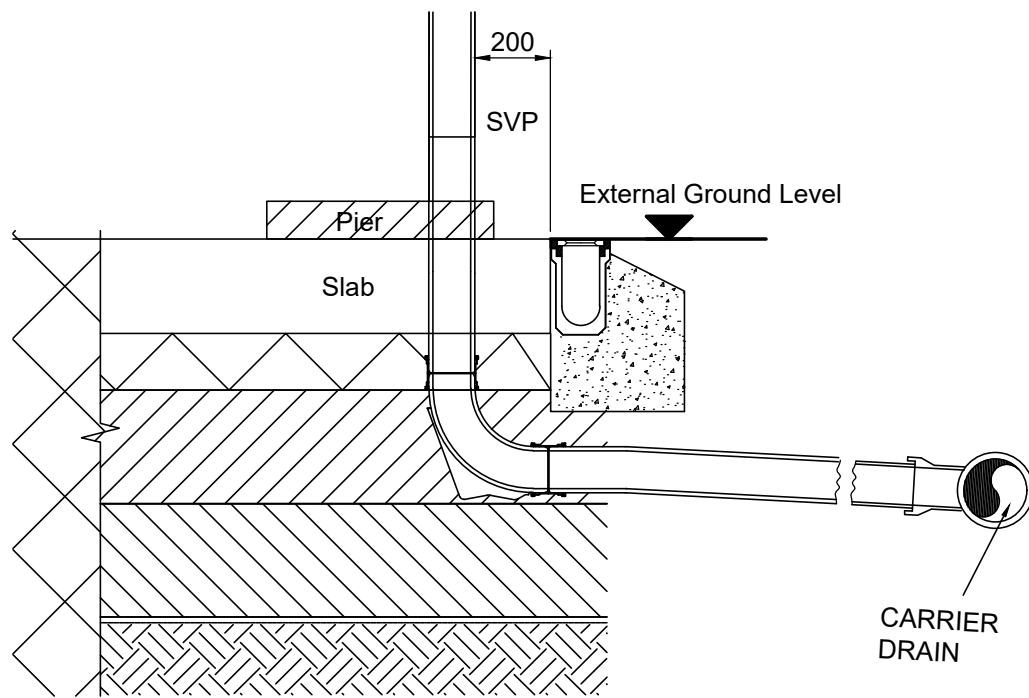
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AD	AM	AM				
STATUS: PRELIMINARY						
UNLESS ISSUED FOR CONSTRUCTION - WORKS AT CLIENT/CONTRACTORS RISK						
SUITABILITY: S3 - Issued for Internal Review and Comment						
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HSA	RDG	XX	XX	DR	C	0506
						REV:
						P02



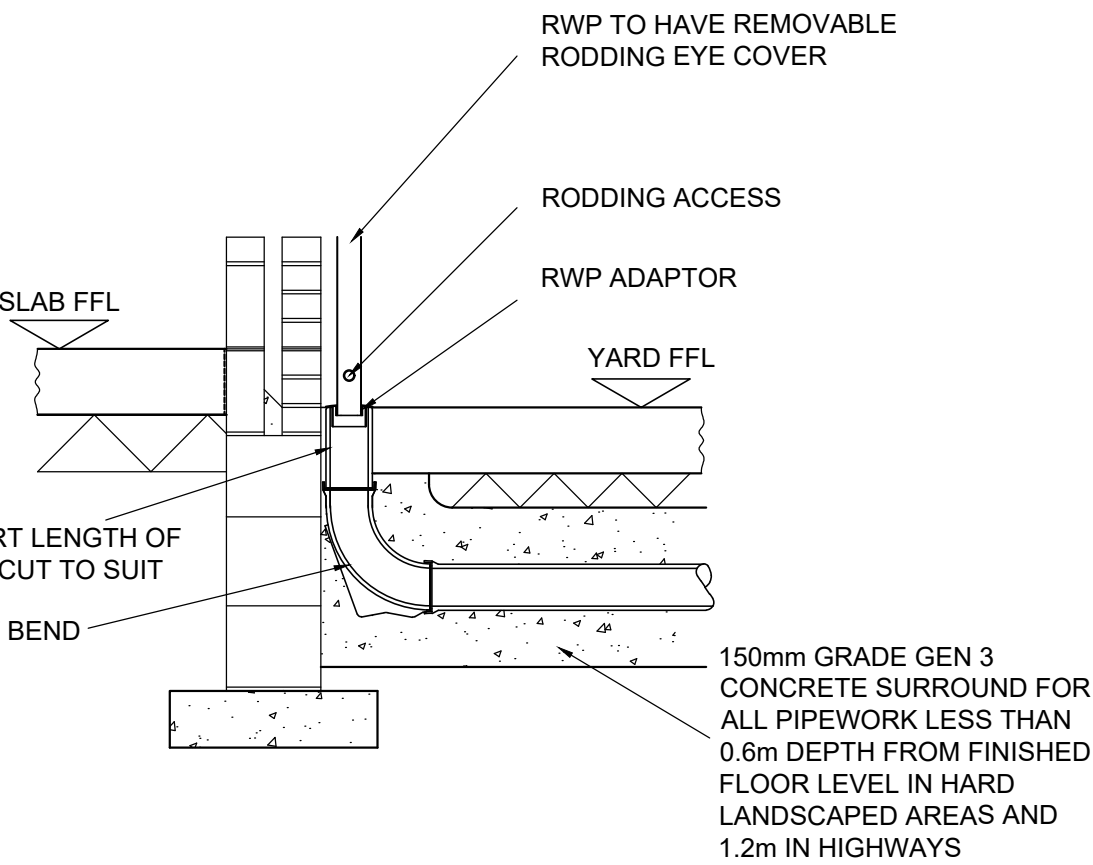
SOIL AND VENT PIPE CONNECTION



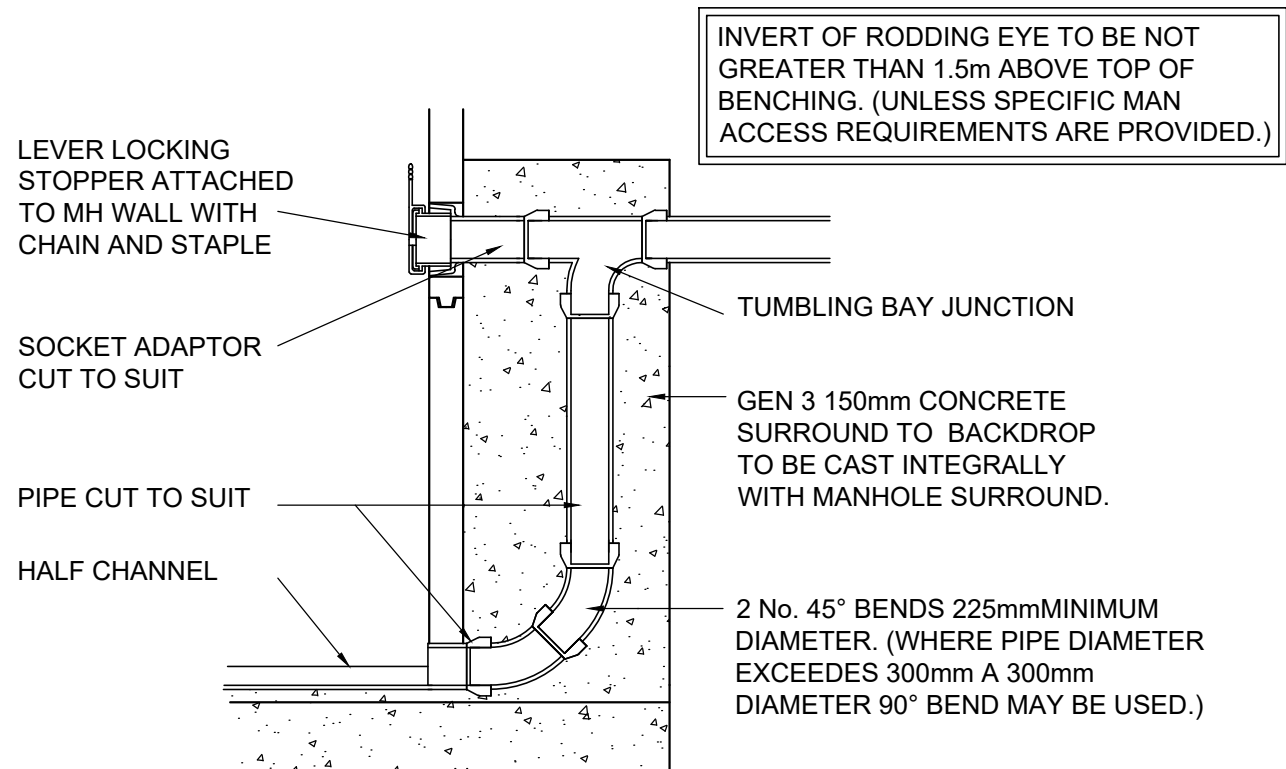
RWP CONNECTION DETAIL



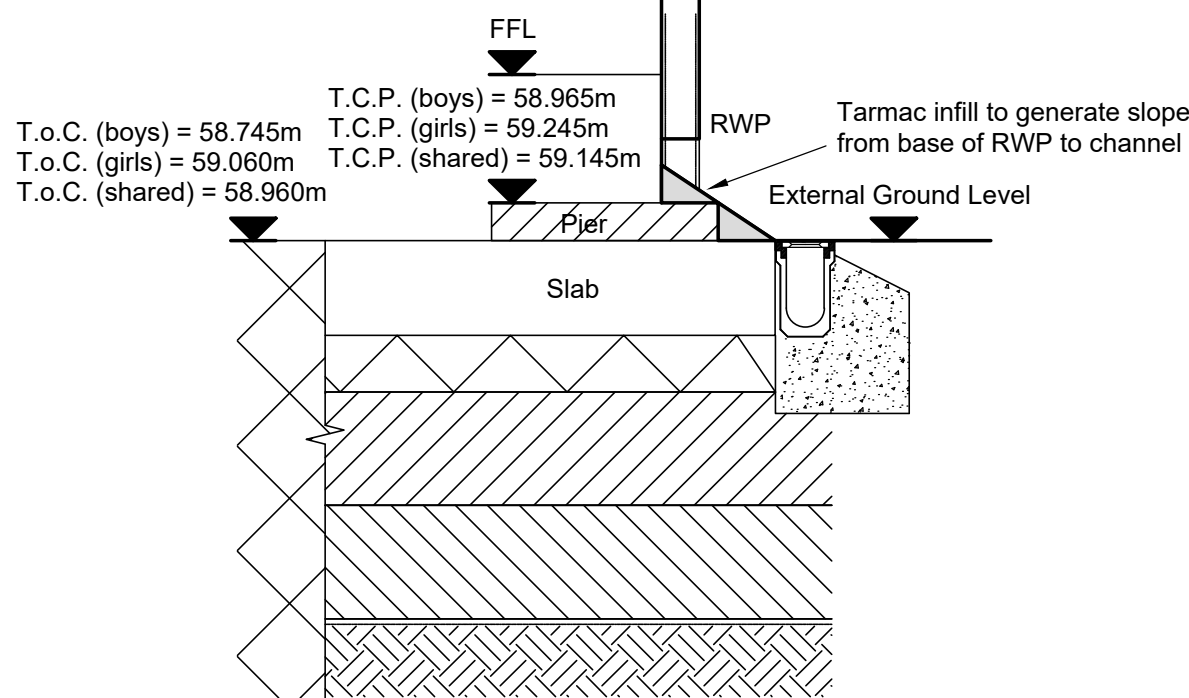
SVP WITH DROP THROUGH SLAB



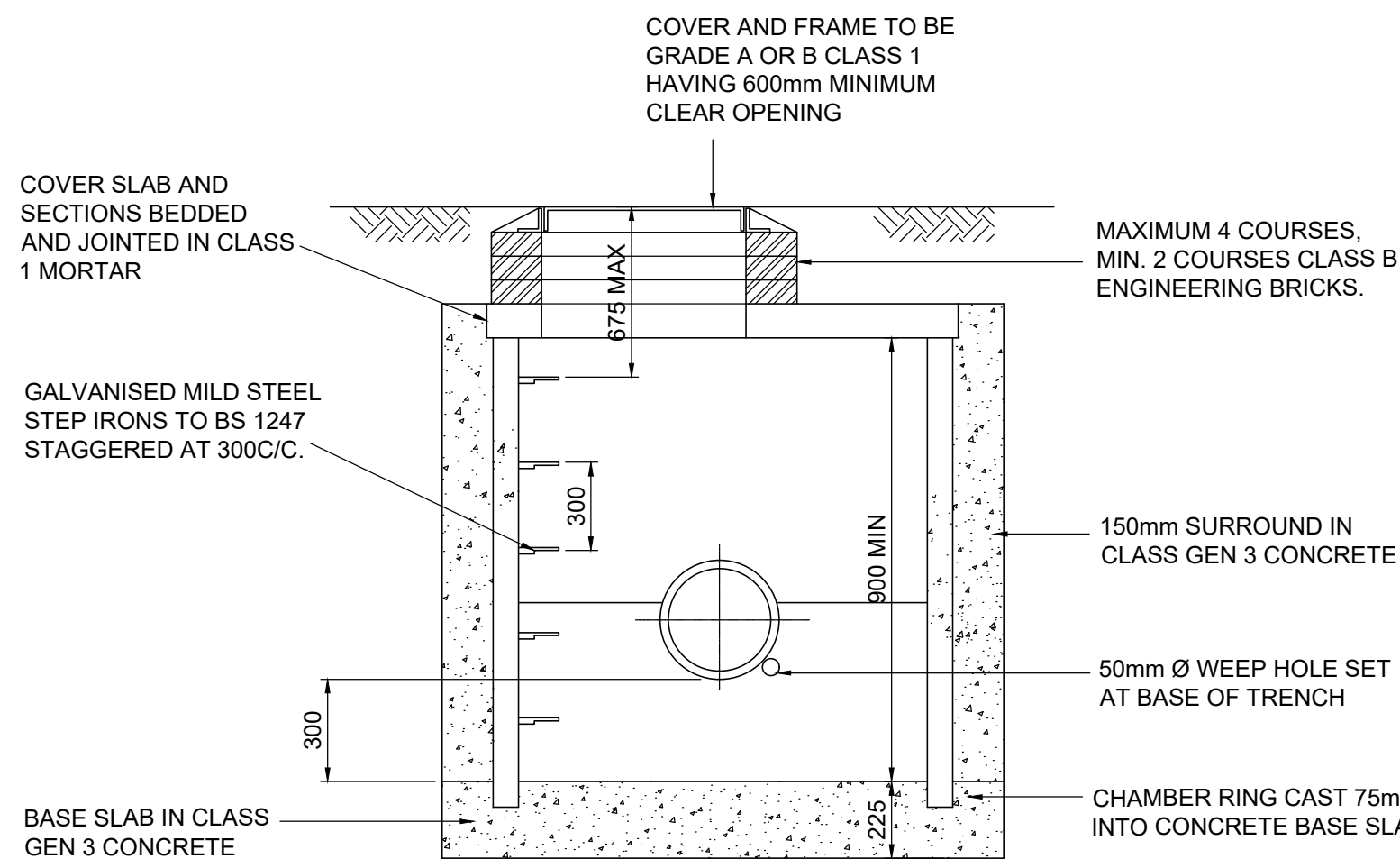
EXTERNAL RAINWATER PIPE CONNECTION



EXTERNAL VERTICAL BACKDROP

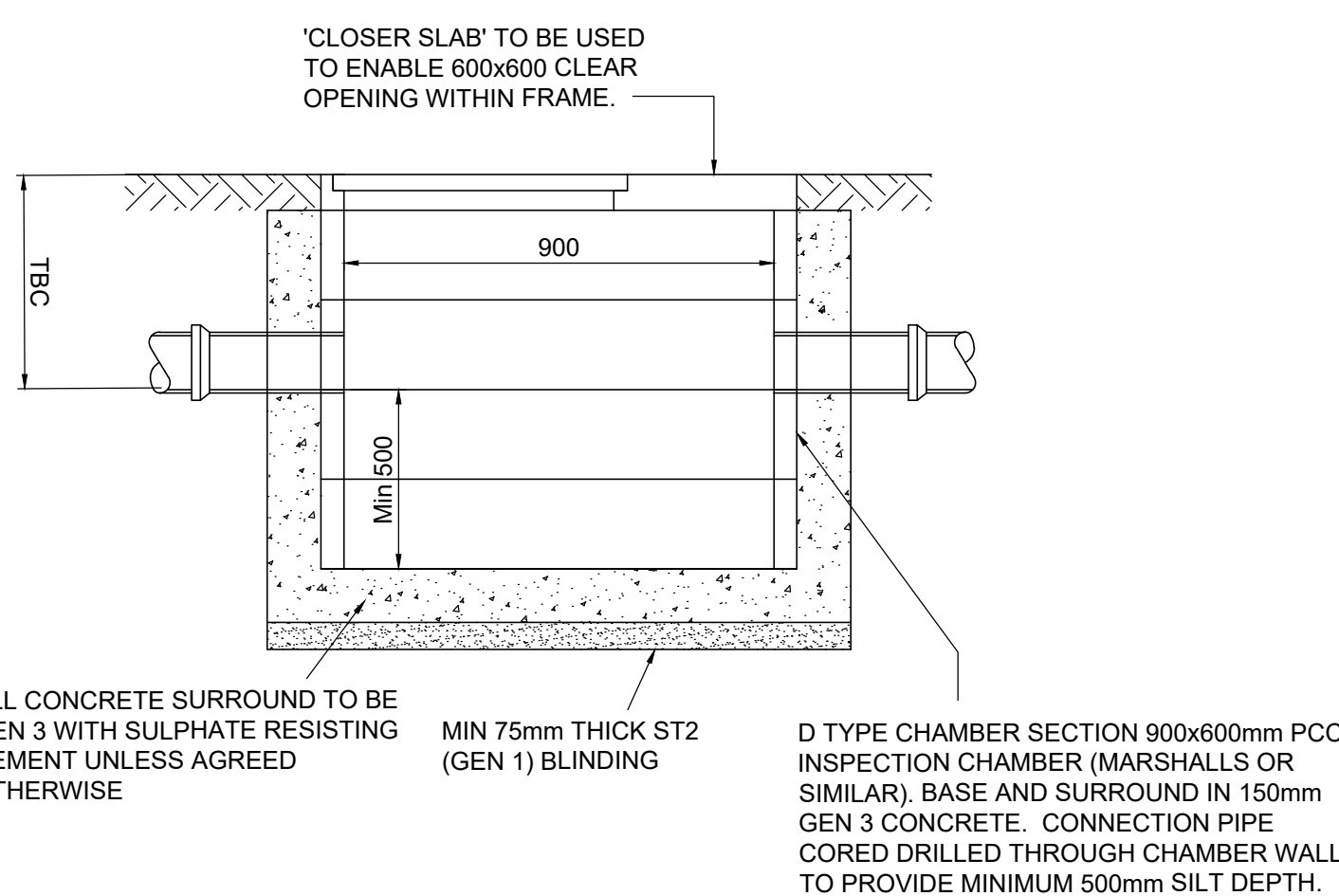


RWP DROP TO CHANNEL DRAIN

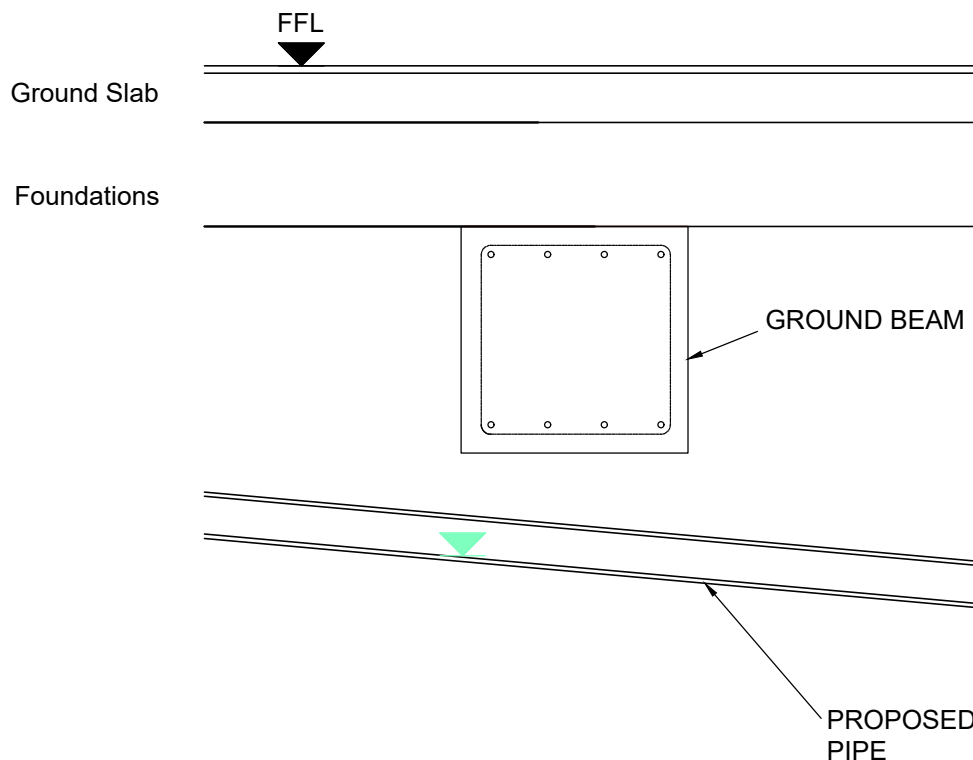


(DEPTH TO TOP OF BASE SLAB 1.2-3.0m)

SHALLOW CATCHPIT



RECTANGULAR PRECAST CONCRETE CATCHPIT



TYPICAL DETAIL OF SVP / RWP PASSING BENEATH PILECAP / GROUND BEAM

OUTLET PIPE Ø mm	CHAMBER Ø mm
100 - 300	1200
375 - 700	1500
750 - 900	1800

NOTE: MANHOLE CHAMBER CONSTRAINED AS PER PCC MANHOLE DETAILS TYPE A & B.

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P03	ADDED CATCH PIT DETAIL	17.10.22	AP	AM
P02	UPDATED TITLE BLOCK	30.09.22	AP	AM
P01	PRELIMINARY ISSUE	22.09.22	AD	AM
REV	DESCRIPTION	DATE	BY	CHKD

ORIGINATOR:

RIDGE

5TH FLOOR
BELVEDERE HOUSE
12 BOOTH STREET
MANCHESTER, M2 4AW

TEL: 0161 833 9579
WWW.RIDGE.CO.UK

CLIENT:

JAGUAR LAND ROVER

IN ASSOCIATION WITH:

PROJECT:

South Apron BIW BUILDING

TITLE:

**PROPOSED DRAINAGE DETAILS
SHEET 3 OF 4**

ENG/TECH:	CSE:	ICSE:	SCALE:	NOT TO SCALE	@	A1
AD	AM	AM	STATUS ISSUE:			

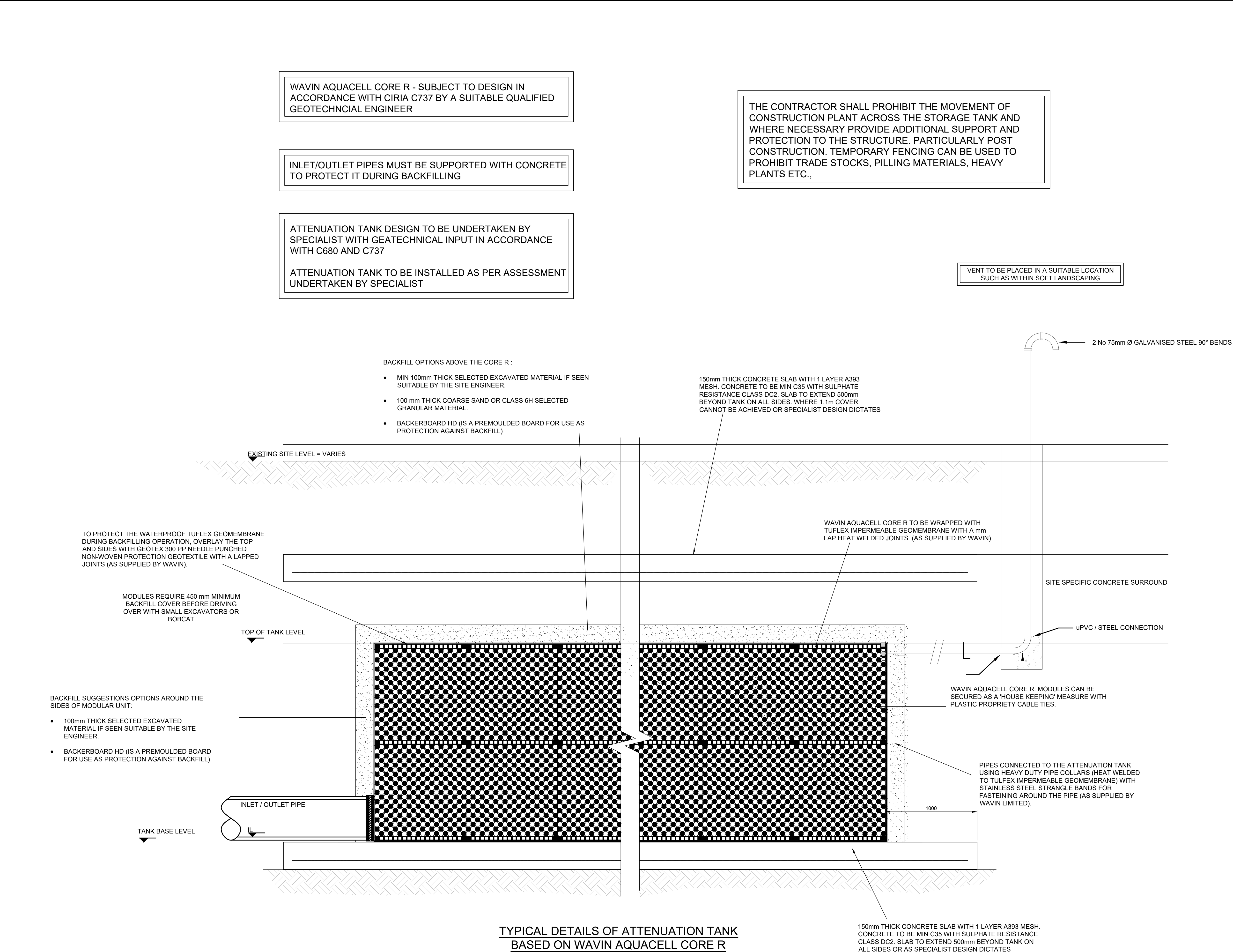
STATUS:

PRELIMINARY

UNLESS ISSUED FOR CONSTRUCTION - WORKS AT CLIENT/CONTRACTORS RISK

SUITABILITY: S3 - Issued for Internal Review and Comment

PROJECT:	ORG:	ZONE:	LEVEL:	TYPE:	ROLE:	NUMBER:	REV:
HSA	RDG	XX	XX	DR	C	0508	P03



TYPICAL DETAILS OF ATTENUATION TANK
BASED ON WAVIN AQUACELL CORE R

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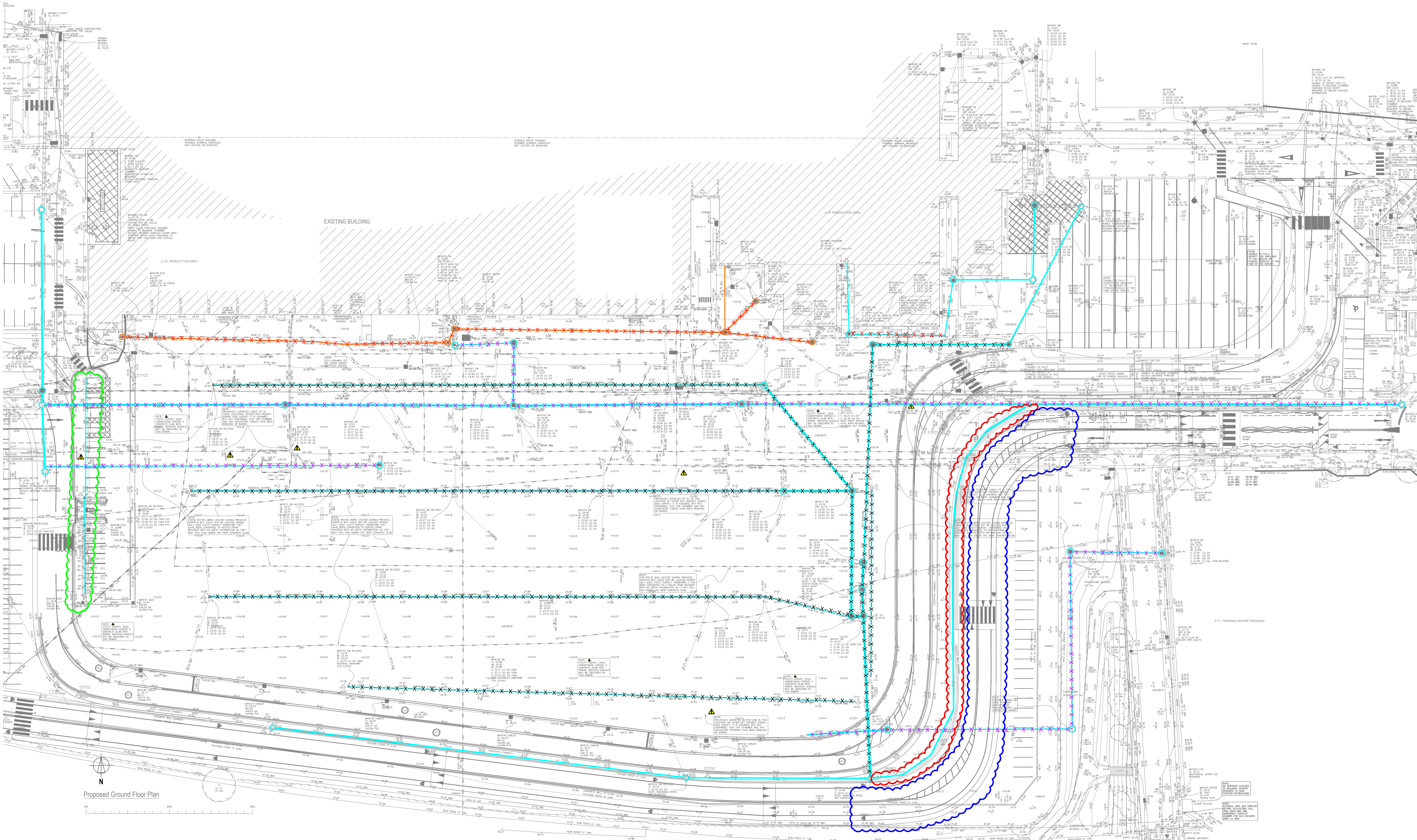
DRAWING NOTES:

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P02	UPDATED TITLE BLOCK	30.09.22	AP	AM
P01	PRELIMINARY ISSUE	22.09.22	AD	AM
REV	DESCRIPTION	DATE	BY	CHKD
ORIGINATOR:				



DRAINAGE KEY

- EXISTING SW DRAIN
- EXISTING FW DRAIN
- PROPOSED CHANNEL DRAIN

- EXISTING SW DRAINS SERVING THE PREVIOUS TEMPORARY BUILDING TO BE ABANDONED / REMOVED. NO CCTV SURVEY REQUIRED.
- EXISTING SW DRAINS REQUIRE A CCTV SURVEY TO CONFIRM IF THE DRAINS ARE IN OPERATION OR NOT. CCTV TO CONFIRM OTHER INCOMING CONNECTION INTO THESE DRAINS (BLIND / SADDLE CONNECTIONS).
- EXISTING DRAINS REQUIRE CCTV SURVEY TO CONFIRM ANY INCOMING CONNECTIONS (SADDLE / BLIND CONNECTIONS) PRIOR TO BE BEING DIVERTED AND REMOVED. EXISTING RWP / SWP CONNECTIONS TO BE DIVERTED.



ADDITIONAL TOPOGRAPHICAL SURVEY REQUIRED FOR THE EXTERNAL HIGHWAY AND POSSIBLE BELOW GROUND SERVICES. THIS AREA IS NOT CURRENTLY PICKED UP ON THE CURRENT TOPOGRAPHICAL SURVEY. THIS INFORMATION IS TO HELP CONFIRM THE SW TANK LOCATION AND ANY OTHER SERVICES.



POSSIBLE SW DRAIN ROUTE, HIGHLIGHTED ON JLR DRAWING REF : EMA1003A PRIVATE DRAIN HIGHLIGHTED REQUIRES A DRAINAGE SURVEY TO CONFIRM THE DRAIN ROUTE, INVERT LEVELS, ITS OUTFALL AND ANY INCOMING CONNECTIONS

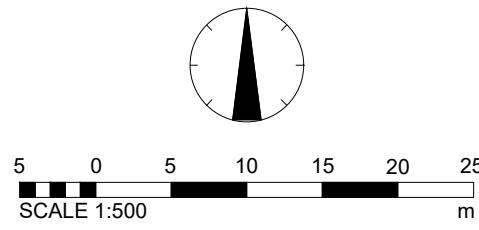


EXISTING SW DRAIN REQUIRES A DRAINAGE SURVEY TO CONFIRM ITS OUTFALL AND EXISTING DRAINAGE INFORMATION (LEVELS, PIPE SIZE)

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P01	ISSUED FOR INFORMATION	03.10.22	AD	AM
REV	DESCRIPTION	DATE	BY	CHKD
ORIGINATOR:				

RIDGE

5TH FLOOR
BELVEDERE HOUSE
12 BOOTH STREET
MANCHESTER, M2 4AW

TEL: 0161 833 9579
WWW.RIDGE.CO.UK

CLIENT:
JAGUAR LAND ROVER

IN ASSOCIATION WITH:

PROJECT:
South Apron BIW BUILDING

TITLE:
EXISTING DRAINAGE AND
PROPOSED ABANDONMENT PLAN

ENG/TECH:	CSE:	ICSE:	SCALE:	1:500	@	A1
AD	AM	?	STATUS ISSUE:	?		
STATUS: PRELIMINARY						
UNLESS ISSUED FOR CONSTRUCTION - WORKS AT CLIENT/CONTRACTORS RISK						
SUITABILITY: S2 - Issued for Information						
PROJECT:	ORG:	ZONE:	LEVEL:	TYPE:	ROLE:	NUMBER:
HSA	RDG	XX	XX	DR	C	0510
						REV: P01

JLR, HALEWOOD BIW SOUTH EXTENSION - DRAINAGE MAINTENANCE SCHEDULE

Organisation responsible for maintenance: _____

Contact Details – Name: _____

Number: _____

Documents:

- Drainage Layout

SUDS have been specified for the site to promote sustainable management of surface water for both flow attenuation and water quality. This document outlines the maintenance schedules for each system in order to maintain the efficiency of the drainage network. The schedules have been created based on guidance from CIRIA C753.

Table 1: Pipes and Manholes Maintenance Schedule

Maintenance schedule	Required Action	Recommended Frequency
Occasional maintenance	Visual inspection of covers, gratings and manhole chambers.	Annually or as required.
	Cleaning out manholes.	Annually or as required.
	CCTV inspection of drainage pipes.	Annually or as required.
Remedial actions	Reactive cleaning of manholes and drains.	During flooding events.
	Cleaning out drains by water jetting.	As required.
	Replace damaged covers, grating and manhole components.	As required.
	Rehabilitation – repairs, relining or replacement.	As determined by inspections.

Table 2: Geocellular Tank Maintenance Schedule

Maintenance Schedule	Required Action	Recommended Frequency
Regular Maintenance	Inspect and identify areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually or as required
	Remove debris from the catchment surface	Monthly
	Remove sediment from pre-treatment structures	Annually

Remedial Actions	Repair / rehabilitate inlets/outlet and vents	As required
Monitoring	Inspect inlets, outlets and vents to ensure they are in good condition and operating as designed.	Annually
	Survey Inside of tank for sediment build up and remove is necessary	Every 5 years or where concerned about operation

Table 3: Catchpit Manhole and Silt Traps

Maintenance schedule	Required Action	Recommended Frequency
Regular maintenance	Remove litter and debris	Monthly or as required.
	Cleaning out manholes.	Monthly or as required.
	Inspect inlets and Outlets and Pipework for Silt Accumulation and establish suitable silt removal frequencies.	Six Monthly
	Remove Sediment from Inlets, Outlets and Pipework	As Required

5018966- JLR HALEWOOD DESIGNERS RISK ASSESSMENT

RIDGE

Client: Jaguar Land Rover

Date of last Update: 17/10/2022

Completed by: Adam Matadar

RISK NO.	FORESEEABLE HAZARDS IDENTIFIED (has potential to cause significant harm and that may not be apparent to those constructing, repairing / maintaining, demolishing or using the structure)	HAZARD APPLIES DURING (Which phase(s) site enabling, construction, repair and maintenance, cleaning, demolition, in use)	COMMENTS (reasons why the hazard cannot be eliminated, and any suggestions / proposals for control measures)	ACTION (owner for further investigations, communication on design drawings, include in O&M manuals)	OWNER
1.	Buried Services	Earthworks, foundation & drainage construction	The contractor is to note the presence of existing buried services on the site and to remove or divert as necessary to facilitate ground works. Known services shown within statutory services documentation.		Main Contractor
2.	Deep excavations	Foundation & drainage construction	Drainage design to fall with gradient of surface, thus reducing depth of excavation. Large pipes may be utilised for attenuation. Retaining walls required in several instances, specifically to amphitheatre seating. Contractor to allow for adequate shoring to all deep excavations/retained earth where required.		Main Contractor / Ridge

Ground conditions vary across the site and the stability of excavations may also vary. Contractor is to seek advice from a Geotechnical Engineer depending on extent of variation.

3. Contamination	Demolition	Further post demolition and site clearance investigations are required to confirm that materials beneath existing features pose no risk to the identified human health receptors.	Main Contractor
4. Possible asbestos in existing buildings to be demolished	Demolition	Asbestos surveys and removal to be managed by specialist subcontractor.	Main Contractor
5. Manual Handling	Drainage Infrastructure construction	Lifting of manholes or pipes - adequate mechanical lifting to be employed where appropriate.	Main Contractor
6. Diversions	Existing Drainage Infrastructure	Ensure the existing drainage is surveyed prior to any diversions. Possible blind / saddle connections would not be picked up and results in internal flooding within the existing buildings. Existing FW drain and SW highway drain currently are located underneath the proposed building. Diversion is required to avoid any new foundations and potential damage to the existing drains.	Provide a plan to the Main Contractor clearly highlighting existing drain that are to remain and existing drains that are to be abandoned. This is only after a CCTV survey is provided by the client. Ridge

7. Construction of the Attenuation Tank	Construction	To be located in an area that does not affect existing services, existing trees or affect the current activities of JLR. Survey of the existing highway and the below ground services is to be conducted by the main contractor.	SW tank located within the contractor's compound. Survey to be reviewed to ensure the SW tank does not encroach the existing highway or affect any Tree Root Zones / TPO's that may be near to the contractor's compound.	Ridge
8. Site has medium risk of flooding	Construction	Ensure the post development runoff rate is in accordance with Knowsley Council LLFA and guidance.	Ensure that the SW tank and drainage infrastructure is suitable sized to accommodate SW flows up to the 1 in 100 year + 45% CC. Also ensure any flow routes are maintained, separately from the main surface water drainage network.	Ridge
9. Working near highways	Construction	Ensure necessary / appropriate traffic management plan is in place alongside suitable fencing / hoarding. Signage to be displayed to ensure site personnel and public. Traffic signals, speed restriction to be employed where necessary.		Main Contractor

Appendix B – Hydraulic Calculations

Outputs from the Microdrainage software for the surface water drainage networks serving the development are provided. Pipe references from the hydraulic models can be located on the drainage layout plan.

Scott Hughes Design Ltd		Page 0
The Flint Glass Works 64 Jersey Street Manchester M4 6JW	JLR BIW, HALEWOOD SW RESULTS	
Date 07/09/2022	Designed by AM	
File SW_P2.MDX	Checked by PB	
Micro Drainage		Network 2018.1

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Proposed SW

Pipe Sizes Pipe Manhole Sizes Manhole

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	0
Ratio R	0.400	Minimum Backdrop Height (m)	0.600
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)	400

Designed with Level Soffits

Network Design Table for Proposed SW

« - Indicates pipe capacity < flow

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	32.447	0.610	53.2	0.600	5.00	0.0	0.600	o	450	Pipe/Conduit	
2.000	26.329	0.070	376.1	0.600	5.00	0.0	0.600	o	450	Pipe/Conduit	
1.001	32.560	0.075	434.1	0.600	0.00	0.0	0.600	o	675	Pipe/Conduit	
3.000	24.071	0.060	401.2	0.000	5.00	0.0	0.600	o	675	Pipe/Conduit	
1.002	36.922	0.246	150.1	0.000	0.00	0.0	0.600	o	225	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	5.19	22.450	0.600	0.0	0.0	0.0	2.79	444.1	81.2
2.000	50.00	5.42	21.910	0.600	0.0	0.0	0.0	1.04	165.8	81.2
1.001	50.00	5.85	21.615	1.800	0.0	0.0	0.0	1.25	447.8	243.7
3.000	50.00	5.31	21.600	0.000	0.0	0.0	0.0	1.30	466.0	0.0
1.002	50.00	6.43	21.540	1.800	0.0	0.0	0.0	1.06	42.3«	243.7

Manhole Schedules for Proposed SW

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SW01	24.250	1.800	Open Manhole	1500	1.000	22.450	450				
SW02	24.250	2.340	Open Manhole	1500	2.000	21.910	450				
SW03	24.050	2.435	Open Manhole	2100	1.001	21.615	675	1.000	21.840	450	
								2.000	21.840	450	
SW TANK	24.000	2.400	Sealed Manhole	0	3.000	21.600	675				
SW04	24.100	2.560	Open Manhole	2400	1.002	21.540	225	1.001	21.540	675	
								3.000	21.540	675	
SW05	23.750	2.456	Open Manhole	900		OUTFALL		1.002	21.294	225	



Micro
Drainage

Checked by PB

Network 2018.1

Scott Hughes Design Ltd		Page 3
The Flint Glass Works 64 Jersey Street Manchester M4 6JW	JLR BIW, HALEWOOD SW RESULTS	
Date 07/09/2022	Designed by AM	
File SW_P2.MDX	Checked by PB	
Micro Drainage		Network 2018.1

Online Controls for Proposed SW

Hydro-Brake® Optimum Manhole: SW04, DS/PN: 1.002, Volume (m³): 30.6

Unit Reference MD-SHE-0191-2100-1800-2100	
Design Head (m)	1.800
Design Flow (l/s)	21.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	191
Invert Level (m)	21.540
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.800	21.0	Kick-Flo®	1.139	16.9
Flush-Flo™	0.532	21.0	Mean Flow over Head Range	-	18.2

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)	Depth (m)	Flow (l/s)
0.100	6.7	0.800	20.4	2.000	22.1	4.000	30.8	7.000	40.3
0.200	17.6	1.000	19.0	2.200	23.1	4.500	32.6	7.500	41.7
0.300	19.9	1.200	17.3	2.400	24.1	5.000	34.2	8.000	43.0
0.400	20.7	1.400	18.6	2.600	25.0	5.500	35.9	8.500	44.3
0.500	21.0	1.600	19.8	3.000	26.8	6.000	37.4	9.000	45.5
0.600	20.9	1.800	21.0	3.500	28.8	6.500	38.9	9.500	46.7

Storage Structures for Proposed SW

Cellular Storage Manhole: SW TANK, DS/PN: 3.000

Invert Level (m) 21.700 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)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	625.0	0.0	1.600	625.0	0.0	1.601	0.0	0.0

Scott Hughes Design Ltd		Page 5
The Flint Glass Works 64 Jersey Street Manchester M4 6JW	JLR BIW, HALEWOOD SW RESULTS	
Date 07/09/2022	Designed by AM	
File SW_P2.MDX	Checked by PB	
Micro Drainage		Network 2018.1

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 20.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.400 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status OFF
 DVD Status ON
 Inertia Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 40, 45

										Water	Surcharged	Flooded
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.		Level (m)	Depth (m)	Volume (m³)
1.000	SW01	15 Winter	1	+0%	30/15 Summer					22.592	-0.308	0.000
2.000	SW02	15 Winter	1	+0%	1/15 Summer					22.396	0.036	0.000
1.001	SW03	15 Winter	1	+0%	1/15 Summer					22.344	0.054	0.000
3.000	SW TANK	60 Winter	1	+0%	30/15 Winter					21.895	-0.380	0.000
1.002	SW04	30 Winter	1	+0%	1/15 Summer					22.270	0.505	0.000

Pipe							Level
PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	Exceeded	
1.000	SW01	0.22		83.2	OK		
2.000	SW02	0.54		76.3	SURCHARGED		
1.001	SW03	0.51		185.1	SURCHARGED		
3.000	SW TANK	0.05		18.5	OK		
1.002	SW04	0.52		20.9	SURCHARGED		

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

Simulation Criteria			
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		
Number of Input Hydrographs	0	Number of Offline Controls	0
Number of Online Controls	1	Number of Storage Structures	1
		Number of Time/Area Diagrams	0
		Number of Real Time Controls	0
Synthetic Rainfall Details			
Rainfall Model	FSR M5-60 (mm)	20.000 Cv (Summer)	0.750
Region England and Wales	Ratio R	0.400 Cv (Winter)	0.840
Margin for Flood Risk Warning (mm)			300.0
Analysis Timestep	2.5 Second Increment (Extended)		
DTS Status			OFF
DVD Status			ON
Inertia Status			ON
Profile(s)			Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080		
Return Period(s) (years)			1, 30, 100
Climate Change (%)			0, 40, 45

										Water	Surcharged	Flooded
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)	Depth (m)	Volume (m³)	
1.000	SW01	15 Winter	30	+40%	30/15 Summer				23.368	0.468	0.000	
2.000	SW02	30 Summer	30	+40%	1/15 Summer				23.316	0.956	0.000	
1.001	SW03	60 Winter	30	+40%	1/15 Summer				23.307	1.017	0.000	
3.000	SW TANK	180 Winter	30	+40%	30/15 Winter				22.741	0.466	0.000	
1.002	SW04	60 Winter	30	+40%	1/15 Summer				22.998	1.233	0.000	

		Pipe		Level	
PN	US/MH Name	Flow / Overflow Cap.	Flow (l/s)	Status	Exceeded
1.000	SW01	0.72	279.2	SURCHARGED	
2.000	SW02	1.66	232.5	SURCHARGED	
1.001	SW03	1.22	442.0	SURCHARGED	
3.000	SW TANK	0.05	19.1	SURCHARGED*	
1.002	SW04	0.52	20.9	SURCHARGED	

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 20.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.400 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status OFF
 DVD Status ON
 Inertia Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 40, 45

										Water	Surcharged	Flooded
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.		Level (m)	Depth (m)	Volume (m³)
1.000	SW01	15 Winter	100	+45%	30/15 Summer					24.087	1.187	0.000
2.000	SW02	15 Winter	100	+45%	1/15 Summer					24.049	1.689	0.000
1.001	SW03	60 Winter	100	+45%	1/15 Summer					23.747	1.457	0.000
3.000	SW TANK	360 Winter	100	+45%	30/15 Winter					23.243	0.968	0.000
1.002	SW04	120 Winter	100	+45%	1/15 Summer					23.603	1.838	0.000

		Pipe				Level	
PN	US/MH Name	Flow / Overflow Cap.	Flow (l/s)	Flow (l/s)	Status	Exceeded	
1.000	SW01	0.93		358.8	FLOOD RISK		
2.000	SW02	2.55		357.5	FLOOD RISK		
1.001	SW03	1.62		583.5	SURCHARGED		
3.000	SW TANK	0.06		19.6	SURCHARGED*		
1.002	SW04	0.52		20.9	SURCHARGED		

Scott Hughes Design Ltd		Page 0
The Flint Glass Works 64 Jersey Street Manchester M4 6JW	JLR BIW, HALEWOOD FLOOD EXCEEDANCE SW RESULTS	
Date 17/10/2022	Designed by AM	
File SW_P2 Exceedance Flows.MDX	Checked by PB	
Micro Drainage	Network 2018.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Proposed SW

Pipe Sizes Pipe Manhole Sizes Manhole

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	0
Ratio R	0.400	Minimum Backdrop Height (m)	0.600
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)	400

Designed with Level Soffits

Network Design Table for Proposed SW

« - Indicates pipe capacity < flow

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	32.447	0.610	53.2	0.600	5.00	0.0	0.600	o	450	Pipe/Conduit	
2.000	26.329	0.070	376.1	0.600	5.00	0.0	0.600	o	450	Pipe/Conduit	
1.001	32.560	0.075	434.1	0.600	0.00	0.0	0.600	o	675	Pipe/Conduit	
3.000	24.071	0.060	401.2	0.000	5.00	0.0	0.600	o	675	Pipe/Conduit	
1.002	36.922	0.246	150.1	0.000	0.00	0.0	0.600	o	225	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	5.19	22.450	0.600	0.0	0.0	0.0	2.79	444.1	81.2
2.000	50.00	5.42	21.910	0.600	0.0	0.0	0.0	1.04	165.8	81.2
1.001	50.00	5.85	21.615	1.800	0.0	0.0	0.0	1.25	447.8	243.7
3.000	50.00	5.31	21.600	0.000	0.0	0.0	0.0	1.30	466.0	0.0
1.002	50.00	6.43	21.540	1.800	0.0	0.0	0.0	1.06	42.3«	243.7



Manhole Schedules for Proposed SW

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SW01	24.250	1.800	Open Manhole	1500	1.000	22.450	450				
SW02	24.250	2.340	Open Manhole	1500	2.000	21.910	450				
SW03	24.050	2.435	Open Manhole	2100	1.001	21.615	675	1.000	21.840	450	
								2.000	21.840	450	
SW TANK	24.000	2.400	Sealed Manhole	0	3.000	21.600	675				
SW04	24.100	2.560	Open Manhole	2400	1.002	21.540	225	1.001	21.540	675	
								3.000	21.540	675	
SW05	23.750	2.456	Open Manhole	900		OUTFALL		1.002	21.294	225	

JLR BIW, HALEWOOD
FLOOD EXCEEDANCE SW RESULTS



Designed by AM

Checked by PB

Network 2018.1

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)	20.000	Storm Duration (mins)	30
Ratio R	0.400		

Scott Hughes Design Ltd		Page 3
The Flint Glass Works 64 Jersey Street Manchester M4 6JW	JLR BIW, HALEWOOD FLOOD EXCEEDANCE SW RESULTS	
Date 17/10/2022	Designed by AM	
File SW_P2 Exceedance Flows.MDX	Checked by PB	
Micro Drainage	Network 2018.1	

Online Controls for Proposed SW

Hydro-Brake® Optimum Manhole: SW04, DS/PN: 1.002, Volume (m³): 30.6

Unit Reference	MD-SHE-0191-2100-1800-2100
Design Head (m)	1.800
Design Flow (l/s)	21.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	191
Invert Level (m)	21.540
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.800	21.0	Kick-Flo®	1.139	16.9
Flush-Flo™	0.532	21.0	Mean Flow over Head Range	-	18.2

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)	Depth (m)	Flow (l/s)
0.100	6.7	0.800	20.4	2.000	22.1	4.000	30.8	7.000	40.3
0.200	17.6	1.000	19.0	2.200	23.1	4.500	32.6	7.500	41.7
0.300	19.9	1.200	17.3	2.400	24.1	5.000	34.2	8.000	43.0
0.400	20.7	1.400	18.6	2.600	25.0	5.500	35.9	8.500	44.3
0.500	21.0	1.600	19.8	3.000	26.8	6.000	37.4	9.000	45.5
0.600	20.9	1.800	21.0	3.500	28.8	6.500	38.9	9.500	46.7

Storage Structures for Proposed SW

Cellular Storage Manhole: SW TANK, DS/PN: 3.000

Invert Level (m) 21.700 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)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	625.0	0.0	1.600	625.0	0.0	1.601	0.0	0.0

200 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Proposed SW

Simulation Criteria			
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		
Number of Input Hydrographs	0	Number of Offline Controls	0
Number of Online Controls	1	Number of Storage Structures	1
		Number of Time/Area Diagrams	0
		Number of Real Time Controls	0
Synthetic Rainfall Details			
Rainfall Model	FSR M5-60 (mm)	20.000 Cv (Summer)	0.750
Region	England and Wales	Ratio R	0.400 Cv (Winter) 0.840
Margin for Flood Risk Warning (mm)			300.0
Analysis Timestep	2.5 Second Increment (Extended)		
DTS Status			OFF
DVD Status			ON
Inertia Status			ON
Profile(s)			Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080		
Return Period(s) (years)			200
Climate Change (%)			40

									Water	Surcharged
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)	Depth (m)
1.000	SW01	15 Winter	200	+40%	200/15 Summer	200/15 Summer			24.255	1.355
2.000	SW02	15 Winter	200	+40%	200/15 Summer	200/15 Winter			24.253	1.893
1.001	SW03	240 Winter	200	+40%	200/15 Summer	200/120 Winter			24.114	1.824
3.000	SW TANK	360 Winter	200	+40%	200/15 Summer				24.000	1.725
1.002	SW04	240 Winter	200	+40%	200/15 Summer	200/180 Winter			24.109	2.344

Flooded				Pipe			
PN	US/MH Name	Volume (m³)	Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded	
1.000	SW01	5.011	0.96	371.4	FLOOD	2	
2.000	SW02	2.728	2.80	392.7	FLOOD	1	
1.001	SW03	63.625	0.70	253.4	FLOOD	5	
3.000	SW TANK	0.000	0.06	20.0	FLOOD	5	
1.002	SW04	9.261	0.62	24.9	FLOOD	3	