

Knowsley Metropolitan Borough Council

HALEWOOD LEISURE CENTRE

Addendum to Halewood Leisure Centre- Flood
Risk Assessment and Outline Drainage Strategy





Knowsley Metropolitan Borough Council

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Assessment and Outline Drainage Strategy

(VERSION 1) PUBLIC

PROJECT NO. 70119719

OUR REF. NO. 70119719_WSP_HDG_RP_0002

DATE: JUNE 2026

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QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	For planning submission			
Date	June 2026			
Prepared by				
Checked by				
Authorised by				
Project number	70119719			
Report number	70119719_WSP_HDG_RP_0002			
File reference	\\uk.wspgroup.com\central data\Projects\70119xx\70119719 KMBC Halewood LUF RIBA 3\03 WIP\Drainage Engineer\05 Reports			

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1 INTRODUCTION

1.1 BACKGROUND

- 1.1.1. This document is an Addendum to the Flood Risk Assessment and Outline Drainage Strategy report (February 2025) produced for Halewood Leisure Centre by WSP on behalf of Knowsley Metropolitan Borough Council.
- 1.1.2. This addendum serves to enhance the initial findings and recommendations, incorporating recent data and ongoing discussions with stakeholders.
- 1.1.3. Key areas of focus in this Addendum include:
- Updates on Ground Investigation (GI) and soil infiltration testing results.
 - Additional details of mitigation measures based on the consultation with the Lead Local Flood Authority (LLFA) and United Utilities (UU).
 - Updates to the drainage strategy as a result of revisions to the site layout.
- 1.1.4. By addressing these aspects, the Addendum aims to ensure that the flood risk management strategy for Halewood Leisure Centre remains robust and comprehensive. This document should be read in conjunction with the original Flood Risk Assessment and Outline Drainage Strategy to fully understand the scope and context of the proposed surface water drainage strategy.

1.2 PROPOSED DEVELOPMENT

- 1.2.1. Since the original Flood Risk Assessment and Outline Drainage Strategy was prepared in February 2025, several amendments to the site layout have affected the proposed drainage design. The key changes include removing the two swales and replacing them with a series of smaller attenuation basins and cellular crate storage, as well as modifications to the car park layout.
- 1.2.2. Proposed changes to the site which influence the management of drainage include the following:
- The existing leisure centre and sports pitch (north of leisure centre) will be retained on site.
 - The two existing multi use games areas (MUGAs) are proposed to be removed.
 - The carpark is proposed to be modified, three new MUGAs and three ponds are to be installed west of the leisure centre, and the entry to the leisure centre (south) is to be resurfaced and extended.
 - Existing drainage infrastructure – except for the network under the carpark – is to be retained.
- 1.2.3. An updated site layout can be found in Appendix A.

1.3 CONSULTATION

- 1.3.1. A summary of consultation undertaken to date and relevant to flood risk and drainage is provided in Table 1-1.

Table 1-1 - Summary of relevant consultation to date

Organisation	Date of Consultation	Summary
Lead Local Flood Authority (Knowsley Metropolitan Borough Council)	03/12/2024	WSP provided description of the proposed drainage strategy for LLFA comments. The outline strategy has been discussed with the

Organisation	Date of Consultation	Summary
		LLFA but discussions are ongoing to agree allowable discharge rates for the site.
	13/02/2025	It was agreed that a high-level drainage strategy would be submitted with the FRA to support the planning application, and further details on the drainage strategy can be submitted later or as part of discharge of condition.
	01/04/2025	A discharge rate of 80l/s was discussed and agreed upon for the site.
	26/06/2025	Meeting to discuss allowable exceedance flows from the site.
	19/11/2025	LLFA confirmed that as the ground investigation was carried out in January which is considered a 'wet month', groundwater monitoring will not be required.
United Utilities	03/12/2024	WSP provided description of the proposed drainage strategy for UU comments.
	06/12/2024	UU advised that the proposal is acceptable in principle. UU also advised that they also would like to see details of the CCTV survey and the current assumptions to be confirmed. UU also advised that the new discharge rate from the site is expected to be as close to greenfield runoff rate of 47l/s as possible. UU also advised they are open for further conversations once the current assumptions are confirmed / clarified.
	19/05/2025	UU confirmed that a discharge rate of 80l/s would be acceptable.
	08/01/2026	UU advised that as their combined sewer is of 300mm diameter, the proposed outfall pipe must be of 300mm dia or less.

2 GROUND INVESTIGATION RESULTS

2.1 GEOLOGY AND HYDROGEOLOGY

- 2.1.1. WSP was instructed by Knowsley Metropolitan Borough Council (KMBC) to undertake a Phase 2 Geo-Environmental Assessment.
- 2.1.2. The ground investigation (GI) was carried out at the Proposed Development area in January 2025. A review of the results of the ground investigation (GI) carried out in the Proposed Development area shows that the site is underlain by topsoil (sandy clayey silt) with underlying made ground (sandy gravelly clay) up to approx. 5m below ground level (bgl). Glacial Till comprising clay with frequent pockets of sand was recorded below made ground.

2.2 SOIL INFILTRATION

- 2.2.1. An onsite infiltration testing to BRE 365 has also been carried out as part of the investigation. The test was run for 300 minutes and the water table did not drop during this time. The results therefore show that infiltration is not feasible at the area of Proposed Development. The results of the soakaway test are shown in Appendix B.

2.3 GROUNDWATER

- 2.3.1. The GI results also show that groundwater seepage and groundwater table were recorded across the site. Groundwater seepage was recorded in range between 0.9m bgl and 2.5m bgl, and groundwater table was encountered at levels in range between 1.9m bgl and 2.7m bgl. No groundwater monitoring was undertaken as part of the GI. A summary of the GI findings in relation to groundwater is shown in Table 2-1. The location of exploratory holes is shown in Appendix C.

Table 2-1 - Ground Investigation – Recorded Groundwater Seepage and Groundwater Table

Exploratory Hole	Groundwater Seepage (m bgl)	Groundwater Table (m bgl)
TP28	2.1	-
TP33	-	2.5
WS06	-	4

3 EXISTING FLOOD RISK

3.1 BASELINE MODELLING

- 3.1.1. In March 2025, NRC conducted a CCTV survey of the drainage system serving the existing site. The findings are included in Appendix D.
- 3.1.2. Based on this survey, a hydraulic model of the existing conditions was developed using Causeway Flow software to assess the current discharge rate and identify any existing flooding issues on site. Where CCTV data was unavailable, the model was supplemented with assumptions outlined in Table 3-1.

Table 3-1 - Assumptions for Existing Model

Assumption
HL MH1- MH not surveyed comment "Lid Seized Unable to raise". CL (18.76m) and IL (15.93m) have been taken from utilities survey
HL MH1- 1500mm dia assumed based on other chamber dimensions
HL MH5- 2100mm dia assumed based on pipe diameter
HL MH8- "Manhole Report HL_MH8" has been disregarded as it is not consistent with other survey data.
Pipe has been assumed to be 900mm dia as per MH Card for HL MH5
HL MH8- coordinates have been assumed based on topographical survey
HL MH8- Nearest cover level from topo has been used (18.02m)
HL MH8- depth to cover assumed to be 1.2m
HL MH8- Assumed to be 1500mm dia based on pipe diameter
HL MH6- assumed that incoming invert is the same as outgoing (if we calculate invert based on depth it gives negative fall over the pipe)
HL MH6- 2100mm dia assumed based on pipe diameter
HL MH7- MH card does not contain a cover level. Cover level has been taken as 15.43m from topographical survey. Invert levels have been calculated using depths from this cover level
HL MH7- 2100mm dia assumed based on pipe diameter
Location of outfall into UU network has been assumed based on location of cover on google maps (topographical does not extend outside of scheme boundary)
Cover level of outfall assumed based on google earth (only accurate to nearest m)
Slope of outgoing pipe assumed to be 1:150

- 3.1.3. Table 3-2 shows the discharge rates and flood volume from the existing network during several storm simulations.

Table 3-2 - Discharge Rates and Flood Volumes for the Existing Network

Return Periods (years)	Discharge Rate (l/s)	Flood volume (m ³)
2	83.1	0
5	97.9	0.6
30	114.0	11.7
100	124.2	18.4
100 + 45% CC	160.3	136.9

4 PROPOSED MITIGATION OF FLOOD RISK

4.1 MITIGATION OF GROUNDWATER FLOOD RISK

- 4.1.1. High groundwater levels have potential to ingress into the proposed below ground drainage features; this would reduce the available attenuation storage. There is also a risk that high groundwater table could impact the integrity of the proposed below ground drainage features and potentially make them float above the ground level due to the upward force of groundwater. Considering this information appropriate mitigation measures will be required.
- 4.1.2. The proposed below ground attenuation storage features will be lined with impermeable membrane to prevent groundwater ingress. In addition, anti-buoyancy solution will be provided for each of the proposed attenuation features to mitigate the risk of them floating above ground. The anti-buoyancy solution design will be supported by appropriate floatation calculations. Details of the anti-buoyancy solution will be developed during detailed design of the project.
- 4.1.3. There is also risk of groundwater using the pipe bedding material as a conduit. Clay stanks in the pipe bedding or similar solution are proposed to be provided to mitigate this potential risk – subject to detailed design.

5 SURFACE WATER MANAGEMENT STRATEGY

5.1 SURFACE WATER MANAGEMENT HIERARCHY

- 5.1.1. The surface water drainage strategy should consider surface water disposal in accordance with the Flood Risk and Coastal Change PPG and NPPF and the National Standards for SuDS, which stipulates that surface water runoff not collected for reuse must be discharged to one or more of the following in order of priority:
- Collected for non-potable use; or, where not reasonably practicable,
 - Discharge into ground (via infiltration); or, where not reasonably practicable,
 - Discharge to a surface water body (watercourse / body); or, where not reasonably practicable,
 - Discharge to a surface water sewer, highway drain, or another drainage system; or, where not reasonably practicable,
 - Discharge to a combined sewer.

5.2 COLLECTED FOR NON-POTABLE USE

- 5.2.1. Without significant modification to the existing leisure centre plumbing and drainage, there is limited demand for storm water to be harvested and reused. There is also no landscape irrigation network, nor storage tank and pumping system to distribute any harvested water. This site is an area identified as 'not seriously water stressed' by the Environmental Agency, as identified in the National Standards for SuDS. Due to both the nature of the development and the classification of the site, it is not considered appropriate for non-potable rainwater harvesting.

5.3 DISCHARGE VIA INFILTRATION

- 5.3.1. Section 2 highlights that infiltration rates are very low for this site. Therefore, the use of this method for managing surface water runoff is not considered viable.

5.4 DISCHARGE TO A WATERBODY

- 5.4.1. As there are no surface waterbodies within the immediate vicinity of the Application Site, the management and discharge of surface water runoff via this method is not considered viable.

5.5 DISCHARGE TO A SEWER

- 5.5.1. The UU sewer records show that there is a 300mm dia combined sewer located along Baileys Lane. The CCTV survey confirms that the existing surface water drainage system ties into this sewer at the north west corner of the site.
- 5.5.2. A Pre-Development Enquiry was submitted to the UU in September 2024 to confirm whether it is acceptable to utilise this connection as part of the proposals and agree the allowable discharge rate. In their response, UU have confirmed that this approach is acceptable. UU also confirmed that the discharge rate of 80l/s is acceptable.

5.6 DESIGN PRINCIPLES

- 5.6.1. The baseline model discussed in section 3 shows that the existing discharge rate from the site is 160 l/s. The LLFA have specified that they want flows around the site to be attenuated to reduce this

rate by 50% to 80 l/s following the development. This proposal was accepted by both UU and the LLFA.

5.6.2. The Proposed Development consists of the following:

- Rearrangement of the existing car park;
- Rearrangement of the hard surfaced area adjacent to the southern and eastern side of the existing building; and
- Removal of the existing 2 No MUGAs, and introduction of 3 No new MUGAs proposed to the west of the existing building. The existing MUGAs are constructed with a permeable surface and covers an area of approx. 1640m². The proposed MUGAs will be also constructed with a permeable surface with underdrainage to ensure that surface water runoff generated in this area is appropriately managed. The new MUGAs will cover an area of approx. 2700m². The total increase in the MUGA area is approx. 1060m².

5.6.3. The proposed changes to the site layout will result in the increase of paved impermeable surfaced area by approx. 800m².

5.7 ATTENUATION STORAGE REQUIREMENTS

5.7.1. The attenuation storage for the Proposed Development will be designed to manage surface water runoff for up to and including 1 in 100 year event with 45% climate change allowance.

5.7.2. Indicative storage volume requirements have been estimated for the proposed development site area, to achieve the reduction of discharge rate required. The gross estimated storage volume is 1478m³ for up to the 1 in 100-year return period storm event including a 45% uplift allowance for climate change. The only current storage within the system is through a series of 1.2m diameter pipes. It has been estimated that these have an attenuation volume of approximately 285m³ so through the proposals an additional 1193m³ of storage is required.

5.7.3. To achieve the reduction of discharge rate required, several attenuation features have been proposed across the scheme including a granular storage layer beneath the proposed MUGAs, three ponds, a crate system beneath the proposed car park and a crate system beneath the new paved area in front of the leisure centre. These features will be designed for the 1 in 100-year event with a 45% climate change allowance. There are a number of flow control features proposed to limit the discharge at various points in the system. The proposed surface water drainage layout is shown in Appendix E. Typical details of the proposed attenuation storage features are shown in Appendix F. The supporting drainage calculations are included in Appendix G.

5.7.4. The above ground attenuation storage features are designed to allow for at least 300mm freeboard.

5.7.5. Table 5-1 shows the proposed storage volumes up to top of banks (including freeboard) and the downstream flow rate, where flow controls are provided.

Table 5-1 - Proposed Development- Attenuation Storage Volumes and Flow rates

Attenuation Feature	Available Storage Volume (m ³), including freeboard	Downstream Flow Rate (l/s)
Pond 1	48.1	2.0
Pond 2	135	3.2

Attenuation Feature	Available Storage Volume (m ³), including freeboard	Downstream Flow Rate (l/s)
Pond 3	113.5	2.4
Car park crates	288.8	18.7 (combined with crate storage)
Crates 1	136.8	18.7 (combined with car park storage)
Crates 2	45.6	18.7 (combined with car park storage)
Crates 3	83.6	18.7 (combined with car park storage)
MUGAs	399.6	0.7

5.8 ATTENUATION STORAGE REQUIREMENTS RELATED TO HIGH GROUNDWATER LEVELS

- 5.8.1. Considering the information related to the presence of high groundwater, as discussed in Section 2.3 of this report, the proposed below ground attenuation storage features will be designed considering the uplift forces to mitigate the risk of hydrostatic uplift pressures. In addition, appropriate mitigation measures will be provided to prevent groundwater ingress into the proposed attenuation storage features. Details of these required mitigation measures will be derived during detailed design stage of the project.

5.9 WATER QUALITY MANAGEMENT

- 5.9.1. Due to the updates to the car park arrangement for the proposed development, rain gardens are no longer feasible to act as the primary pollution control for the runoff generated. As a result, surface water runoff generated in the car park is proposed to flow through a Class 1 by-pass oil separator prior to discharge to a cellular crate system.

5.10 OPERATIONAL AND MAINTENANCE REQUIREMENTS

- 5.10.1. Due to the updates to the site layout the operational and maintenance requirements outlined in the original Flood Risk Assessment and Outline Drainage Strategy have been updated.
- 5.10.2. The maintenance regime required for ponds is summarised in Table 5-2.
- 5.10.3. KMBC confirmed the following in relation to the responsibility for maintenance activities, including maintenance of the drainage features:
- Everything behind the fence, including the existing building, existing pitch and proposed MUGAs will be maintained by Volair;
 - The remainder of the Proposed Development will be maintained by KMBC.
- 5.10.4. A Plan indicating the maintenance responsibility areas is show in Appendix H.

Table 5-2 - Operation and Maintenance Requirements for Ponds

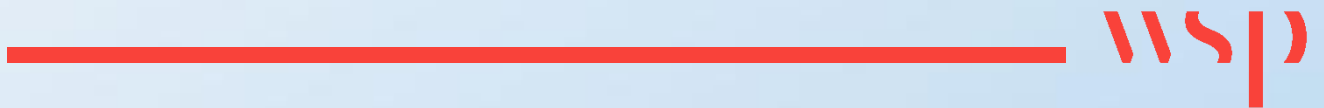
Maintenance Type	Required action	Frequency
Regular maintenance	Remove litter and debris	Monthly
	Cut grass	Monthly or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	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
	Inspect flow control mechanisms for blockage, and clear if required.	Monthly
	Tidy all dead growth before start of growing season	Annually
Occasional maintenance	Vegetation replacement / reseed areas of poor vegetation growth	As required
Remedial actions	Repair erosion or other damage by re-seeding or re-turfing	As required (inspect after major storms during the first year)
	Repair / rehabilitation of inlets and outlets	As required

6 CONCLUSIONS

- 6.1.1. This addendum provides a comprehensive update to the original flood risk assessment and drainage strategy for the proposed development at Halewood Leisure Centre. The addendum incorporates recent ground investigation results, stakeholder consultations, and revisions to the site layout, ensuring that the flood risk management approach remains robust and fit for purpose.
- 6.1.2. Onsite testing confirmed that infiltration is not feasible due to low rates and high groundwater levels. Appropriate mitigation measures, such as impermeable membranes and anti-buoyancy solutions, are proposed to protect below-ground attenuation features from groundwater ingress and uplift forces.
- 6.1.3. Due to site constraints, surface water will be discharged to the existing combined sewer at a controlled rate of 80 l/s, as agreed with both the Lead Local Flood Authority and United Utilities.
- 6.1.4. The proposed development will increase impermeable surface area, requiring additional attenuation storage. A combination of ponds, granular storage layers, and crate systems will provide the necessary storage to manage runoff from up to a 1 in 100-year storm event, including a 45% climate change allowance.
- 6.1.5. Updated maintenance regimes have been outlined to ensure the long-term effectiveness of drainage features, with responsibilities clearly defined between Volair and Knowsley Metropolitan Borough Council.
- 6.1.6. In summary, the proposed flood risk mitigation and drainage strategy for Halewood Leisure Centre is designed to meet regulatory requirements, address site-specific challenges, and provide resilient protection against future flood risks. Continued collaboration with stakeholders and adherence to the outlined operational and maintenance protocols will be essential for the successful implementation and long-term sustainability of the scheme.

Appendix A

UPDATED SITE LAYOUT



Appendix B

SOIL INFILTRATION RATE (SOAKAWAY) TEST



Appendix C

GI EXPLORATORY LOCATIONS



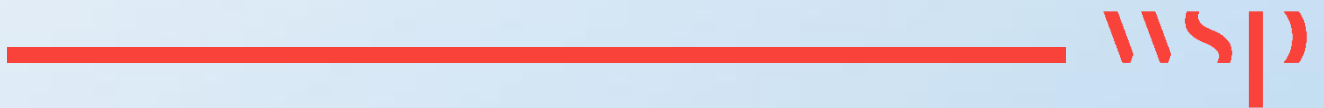
Appendix D

CCTV SURVEY RESULTS



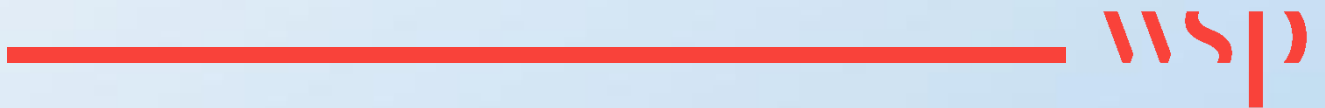
Appendix E

SURFACE WATER DRAINAGE LAYOUT



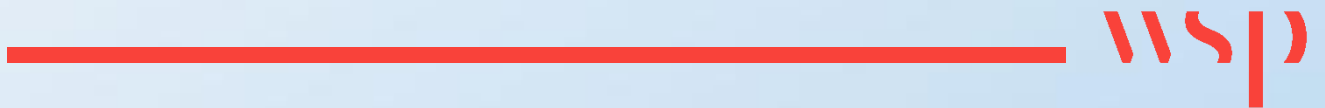
Appendix F

DETAILS FOR ATTENUATION FEATURES



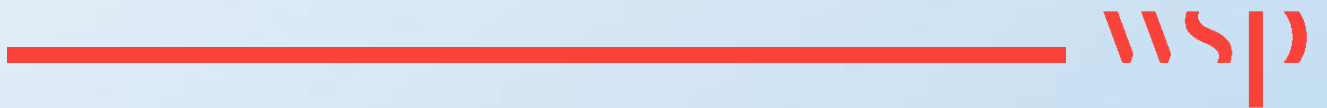
Appendix G

DRAINAGE CALCULATIONS



Appendix H

MAINTENANCE RESPONSIBILITIES PLAN





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