ECC22.2

Wirral Level 2 Strategic Flood Risk Assessment – Site Screening Report

Final Report

February 2022

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Wirral Level 2 Strategic Flood Risk Assessment

JBA

WELPS 079

Final Report

February 2022

www.jbaconsulting.com



JBA Project Manager

Mike Williamson JBA Consulting Second Floor Phoenix House Lakeside Drive Centre Park Warrington WA1 1RX

Revision History

Revision Ref/Date	Amendments	Issued to
V1.0 Draft September 2021	-	John Entwistle
V2.0 Draft December 2021	Council and EA comments addressed	John Entwistle
V3.0 Final February 2022	Council comments addressed	John Entwistle

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Purpose

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Abbreviations

AOD	Above Ordnance Datum
BGS	British Geological Survey
EA	Environment Agency
FRCC-PPG	Flood Risk and Coastal Change Planning Practice Guidance
FMfP	Flood Map for Planning
FAA	Flood Alert Area
FRA	Flood Risk Assessment
FWA	Flood Warning Area
HFM	Historic Flood Map
LIDAR	Light Detection and Radar
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
RFM	Reservoir Flood Map
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
UU	United Utilities
WFD	Water Framework Directive



WELPS 079: Former	Bidston Dock, Wallasey Bridge Road	
Location	Wallasey Bridge Road	
Site area (ha)	18.31	
Watercourse	The Birket and Mersey Estuary	
EA Model used	Mersey Estuary 2018	
Existing use	Brownfield	
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable	
Proposed use	Employment	
Proposed development flood risk vulnerability classification (NPPF)	Less vulnerable	
Proposed development impermeable area (ha)	15.56	



Figure 1: Existing tidal flood zones and flood risk data

This site includes a large area of Flood Zone 3b. It is understood that this area used to form part of the dock and his since been infilled. The area is now an area of scrubland and therefore designated Flood Zone 3b.





The elevation does not vary substantially across the site remaining at approximately 7 mAOD other than a small section in the north which has higher elevation ranging between 10 and 12 mAOD. There is a large area just outside the site boundary to the west with a much higher elevation of approximately 27 mAOD.

Flood Source: Tidal					
Flood Zones	Flood Zone 3b	Flood Zone 3b +climate change*	Flood Zone 3a	Flood Zone 3 +climate change*	Flood Zone 2
	23.9%	N/A	0.4%	+13.5%	0%
Tidal: maximum depth	N/A	4.73 m	3.35 m	5.55 m	N/A

WELPS 079: Former Bidston Dock, Wallasey Bridge Road

Flood Zone 3b figures stated based on defended model; Flood Zone 3a and 2 figures stated based on undefended model

*Climate change figures based on 70th percentile (higher central allowance)

Modelled tidal risk including climate change (Mersey Estuary 2018 model) NOTE: modelled outputs for this SFRA are subtly different to original 2018 modelled outputs due to upgraded modelling and GIS software







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WELPS 079: Former	Bidston Dock, Wallasey Bridge Road
Flood Warning Area	According to the EA's FWA dataset, there is a FWA in operation just outside of the site boundary to the east for the Irish Sea and Mersey Estuary from the Head of the Wirral to Runcorn.
Natural Flood Management / Working with Natural Process	The site lies outside the national scale 'potential for WwNP dataset'.
Observations, mitigation options & site suitability: tidal	 Almost a quarter of the site is within tidal Flood Zone 3b. This area is isolated to the centre of the site. This area should be left open and developed into amenity greenspace. Development can be allocated to the areas in Flood Zone 1 that surround this area. The 0.5% AEP +CC Mersey Estuary outline extends further into the site covering an additional 14%. Flood depths are shallow and hazards are very low for the majority of the site, excluding the area within Flood Zone 3b in the central area of the site. The central area of the site and along the southern and eastern boundaries of the site are modelled to flood during the 0.5% AEP +CC event. The maximum depth is approximately 5.5m located along the eastern boundary. Depths are generally high within the central portion. The site is virtually split in two by the area of functional floodplain which may make the provision of safe access and egress routes more challenging. Raised pedestrian walkways over the area should be viable via the A5139 for the northern section of the site as it remains free from tidal inundation during the 0.5% AEP event, and via Wallasey Bridge Road for the southern section of the site as it remains free from tidal inundation. The northern section of the site would still have safe access and egress via the A5139 during the 0.5% AEP +CC event. Wallasey Bridge Road in the south east corner of the site becomes inundated to a maximum depth of 1.1 m and therefore may not be viable for safe access. Also, aflood risk activity permit may be required as the site is within 16 metres of the tidally influence Mersey Estuary. Details on obtaining a Flood Risk Activity Permit are available from the EA.
Flood source infrast	tructure failure – reservoirs (residual)
Flood risk: reservoir	There is no risk of flooding to the site as a result of dam failure, according to the EA's online RFM.
Flood source: infrast	ructure failure – canals (residual)
Flood risk: canal	There are no canals in the vicinity of the site.



Figure 6: 1% AEP event surface water flood depths (Risk of Flooding from Surface Water map)



Figure 7: 1% AEP event surface water flood hazards (Risk of Flooding from Surface Water map)

* Surface water hazard rating based on Table 4.2 Hazard to People as a Function of Velocity and Depth, R&D OUTPUTS: FLOOD RISKS TO PEOPLE: PHASE 2 FD2321/TR2. Defra. March 2006.

Surface water flood risk to development site	Surface water risk to the site is minimal. The risk in all events is primarily localised to the north east corner of the site; this is where the elevation drops from around 11 m to 7 m.
	Safe access and egress are viable via the A5139 as it remains free from inundation during the 1% AEP event.
Climate change	The current day 0.1% AEP event outline provides an indication of the likely increase in extent of the more frequent events.
	The 0.1% AEP event outline covers just over 10% of the total site area and the extent is localised to the north east corner. The A5139 becomes partially inundated

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WELPS 079: Former	Bidston Dock, V	Vallasey Br	idge Road			
	to the east w range betwee viable.	ith the we en 0.15 an	st remaining fre d 0.3 m, safe a	ee from inundat ccess and egres	ion but as dep ss via this roac	ths in the east I should remain
Observations, mitigation options & site suitability: surface water	 It is like new de A full de surface require 	 It is likely this site will be cleared and the land regraded and rezoned to suit new development. A full drainage strategy would be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. This will require consultation with the LLEA 				
Surface Water Flo	ood Risk from	Proposed	d Developmen	t		
Runoff rates should aimed for. For the calculated below ba (I/s).	not exceed cu purposes of thi ased on an assu	rrent rates s assessm med 85%	and if possible ent, the require impermeable a	, betterment of ed volumes of at rea and limiting	existing rates tenuation hav greenfield rur	should be e been noff rate of Qbar
Proposed developme Obar: 81.06 l/s (FEI Q30: 137.81 l/s Q100: 168.61 l/s	ent limiting run H Statistical)	off rate: (I	/sec)			_
Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volum e m ³	Outflow volume m ³	Attenuation required m ³	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	9.5	9813	1941	7872	38.4	0.525 ha 2.866 %
30yr Rainfall+40%	10.75	11727	2196	9531	46.5	0.635 ha 3.470 %
100yr Rainfall+20%	10.75	13395	2196	11199 (3327 exceedance storage)	54.7	0.747 ha 4.078 %
100yr Rainfall+40%	12	15906	2451	13455 (3924 exceedance storage)	65.7	0.897 ha 4.899 %
Climate change	Application o change antici attenuation v	f the centr pated for olumes for	al (+20%) and the 2080s in th r the 1% AEP a	upper end (+40 e table above sh nd 3.33% AEP r) allowance nows the estim ainfall events.	s for potential nated
Surface water: flood risk impacts from development site, mitigation & SuDS	As part of thi land take if a development Attenuation v AEP event wi development managed on	s Level 2 S pond with volumes ar th exceeda worsening site.	SFRA we have i an assumed d e presented for ance flows quar g flood risk else	ncluded calculat epth of 1.5m wa the critical stor ntified up to the where, surface	ions to provide as included as m duration for 1% event. To water runoff m	e an estimated part of the r the 3.33% o prevent nust be



IRA

WELPS 079: Former	Bidston Dock, Wallasey Bridge Road
Recommendation summary	 Based on the evidence presented in the Level 1 SFRA and this Level 2 SFRA: Early discussions should take place with the EA and or the landowner with regards to the onsite dock area, in terms of options for including the waterbody within the site layout. The EA offers early engagement through an advisory service via their website (https://www.gov.uk/guidance/developers-get-environmental-advice-on-your-planning-proposals) or by emailing the local office: SPPlanning.RFH@environment-agency.gov.uk. Careful planning and site design around the area of functional floodplain. Resilience measures should be included early on in site design and planning. Access and egress should be improved by linking the northern and southern areas of the site via raised pedestrian walkways.
Can the second part of the Exception Test be satisfied?	Site not subject to the Exception Test though development may be permitted assuming the functional floodplain is left open onsite and effective resilience measures and emergency escape routes are put in place
FRA requirements	 The FRA should include emergency planning procedures with consideration to safety around the area of function al floodplain and ensuring safe access and egress routes in times of flood. Appropriate resilience measures should be investigated. The FRA should include a drainage strategy for the proposed new development layout. Any FRA should be carried out in line with the NPPF; FRCC-PPG; Local Plan and LLFA policies; and national and local SuDS policy and guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and the emergency services.
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Wirral Level 2 Strategic Flood Risk Assessment

JBA

Site 0752

Final Report

February 2022

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Revision History

Revision Ref/Date	Amendments	Issued to
V1.0 Draft September 2021	-	John Entwistle
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V2.0 Final February 2022		John Entwistle

Prepared by	Maria Botterill BSc
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Reviewed by	Mike Williamson BSc MSc CGeog FRGS EADA
	Principal Flood Risk Analyst

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LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
RFM	Reservoir Flood Map
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
UU	United Utilities
WFD	Water Framework Directive

0752: Land at Woodside, Chester Street, Birkenhead			
Location	Woodside, Chester Street, Birkenhead, Wirral		
Site area (ha)	9.3		
Watercourse	Mersey Estuary		
EA Model used	Mersey Estuary 2018 Model		
Existing use	Employment		
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable		
Proposed use	Residential		
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable		
Proposed development impermeable area (ha)	7.9		

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Figure 1: Existing tidal flood zones and flood risk data

The site sits adjacent to the Mersey Estuary and includes a jetty area which is within Flood Zone 3b. The northern and eastern areas of the site fall within Flood Zone 2 and 3. A Flood Warning Area (FWA) is in place across the Flood Zone 2 and 3 areas, and a Flood Alert Area (FAA) is in place across the area of the site within Flood Zone 3. There is no historic flooding mapped within this area.



Figure 2: Topography

The elevation does not vary substantially across the site. The topography generally slopes north eastwards towards the estuary. Elevation varies from higher ground in the southwest, approx. 17 m AOD down to the estuary.

Flood Source: Tidal					
Flood Zones	Flood Zone 3b	Flood Zone 3b +climate change*	Flood Zone 3a	Flood Zone 3a +climate change*	Flood Zone 2
	7.1%	FZ3b +59.1%	32.1%	FZ3a +36.5%	18.6%
Tidal: maximum depth	N/A	3 m	2.4 m	3.4 m	N/A
All figures stated based on undefended model					

*Tidal climate change figures based on higher central allowance (70th percentile)

0752: Land at Woodside, Chester Street, Birkenhead

Modelled tidal risk including climate change (Mersey Estuary 2018 model) NOTE: modelled outputs for this SFRA are subtly different to original 2018 modelled outputs due to upgraded modelling and GIS software



Figure 3: Mersey Estuary 0.5% AEP tidal event baseline flood depths (m)

Note: Modelled baseline flood extents for the 0.5% AEP event vary slightly from the existing Flood Zone 3a outlines. This is a result of the existing flood zones using the old Coastal Flood Boundaries (CFB) from 2011 and the model having a base year of 2015. The previous CFB excluded data from the Class A gauge at Liverpool due to differences with the surrounding gauges at Heysham and Hilbre Island. The new CFB in 2018 included gauge data from Liverpool and an uplift was added to get the model to a base year of 2021, meaning the levels at the mouth of the estuary increased by over 0.3m causing additional flooding to certain areas.

The current Flood Map for Planning therefore will underestimate present day tidal flood risk to the Wirral. The tidal models should be updated with the new CFB data. As more recent data is available which hasn't been built into the flood zones, a precautionary approach should be adopted pending the updating of the tidal models and subsequent updates to the Flood Map for Planning.





2021s1045 Wirral Level 2 SFRA - Site 0752 v2.0





2021s1045 Wirral Level 2 SFRA - Site 0752 v2.0

0752: Land at Woodside, Chester Street, Birkenhead model) layout options are established. The elevation of the site was uplifted by 4.68 m to reflect the maximum levels for the 0.5% + CC (higher central) event +600 mm freeboard, as recommended by the EA. The updated maximum elevation within the site boundary therefore increased to 12.8 mAOD. Figure 8 shows the entire site to be flood free when compared to the baseline 0.5% AEP +CC extent. As a result of land raising, modelled depths to the north of the site have considerably decreased when compared to the baseline climate change event in Figure 6. Outputs from the modelling indicate flow is being directed away from the site due to the increased elevation and is re-entering the estuary at 332818, 389610. This is beneficial to the industrial development located around Shore Road. Depths to the south of the site are modelled to increase by around 10mm compared to the baseline event. Hazard ratings to the north of the site have generally decreased, with less areas being categorised as 'Danger for all'. Hazard ratings to the south of the site have remained largely the same due to the small observed differences in depths. EMP-RA3.1 332818, 389610 9 Hamilton Square Legend Site boundary Police Station Land raising 0.5% AEP +CC Baseline 0.5% AEP +CC STREER Metres HORNBY 180 270 90 360 ontains Ordnance Survey data © Crown copyright and database right [2021] on Figure 8: modelled tidal extents for the 0.5% AEP plus climate change land raising scenario





JRA

0752: Land at Woodside, Chester Street, Birkenhead				
	 The site is at risk from tidal sources (according to the Mersey Estuary 2018 model) from the Mersey Estuary. 7.1% of the site is within Floord Zere 2b and the site is within Floord Zere 2b and the site is within Floord Zere 2b and the site is a site in the site is within Floord Zere 2b and the site is a site in the site in the site is a site in the site is a site in the site in the site is a site in the site in the site is a site in the site in the site is a site in the site in the site is a site in the site in the site is a site in the site in the site is a site in the site in the site is a site in the site in the site in the site in the site is a site in the site in the site is a site in the site is a site in the site in the			
	 7.1% of the site is within Flood Zone 3b and therefore should not be developed. However, this risk appears confined to the edge of the site boundary adjacent to the Mersey Estuary and primarily within the ferry terminal area. 			
	- The area within Flood Zone 3a should not be developed for residential purposes, however, given the risk is tidal, land raising could be possible without having to provide compensatory storage. Given the modelled onsite depths are significant, land raising would likely be a costly solution. At this stage, land raising may place development above the 0.5% AEP undefended event plus maximum climate change level of 3.9m plus 600mm of freeboard, as recommended by the EA.			
	 Land raising could be a viable option to consider for development at this site. The modelled land raising scenario indicates raising the levels of the site to the 0.5% AEP +CC maximum level, plus 600mm freeboard, would protect the site from tidal flooding in the long term. However, raising the site above the required level of 4.68 m would represent a considerable undertaking. The modelled depths to the south of the site have increased by around 10mm. Depths to the rest of the area surrounding the site have decreased. Outputs from the modelling indicate flow is being directed away from the site due to the increased elevation and is re-entering the estuary at 332818, 389610. Stilted development may be an option though is likely to be an expensive 			
	design solution with access and egress routes also required to be above the design flood level.			
	- A further option may be for ground floor parking or other less vulnerable uses (i.e. non-residential such as shops, restaurants, offices) and for habitable dwellings to be situated on first floor and upwards. However, safe access and egress routes must be available at times of flood, even for above ground floor accommodation.			
	 Development would ideally be directed towards the Flood Zone 1 area however this will likely contain the main access and road links to the site. 			
	- Safe access and egress routes must be available at times of flood and appear to be available from the southwest of the site, via Chester Street and the northwest via Canning Street. A FWA is in place however which should provide advanced warning for site users to evacuate ahead of a flood event in the short term.			
	- Given the modelled risk from climate change and the difficulties with access and egress routes, it is recommended this site should not be developed for residential use. Ideally, this site would remain for less vulnerable uses with appropriate resilience measures put in place or be used as a multifunctional greenspace for flood storage, amenity use and to provide environmental/ecological benefits.			
	 A flood risk activity permit may be required as the development is within 16m of the Mersey Estuary. Details on obtaining a Flood Risk Activity Permit are available from the EA. The EA also recommends for an 8m no development buffer alongside any watercourse to allow for maintenance access. 			
Flood source: infrast	ructure failure – reservoirs (residual)			
Flood risk: reservoir	There is no risk of flooding to the site as a result of dam failure, according to the EA's online RFM.			
Flood source: infrast	ructure failure – canals (residual)			
Flood risk: canal	There are no canals in the vicinity of this site.			

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Figure 12: 1% AEP event surface water flood hazards (Risk of Flooding from Surface Water map)

* Surface water hazard rating based on Table 4.2 Hazard to People as a Function of Velocity and Depth, R&D OUTPUTS: FLOOD RISKS TO PEOPLE: PHASE 2 FD2321/TR2. Defra. March 2006.

Surface water flood risk to development site	Approximately 5% of the site is at risk of surface water flooding in the 1% AEP event to depths between 0.9m and 1.2m and with some areas of significant hazard. This risk is primarily focused to the area with the greatest coastal risk. The land here is low-lying and utilised as a Ferry Terminal. Overall, the area of the site at risk of surface water flooding is low and looks to be constrained by current development.
Climate change	The current day 0.1% AEP event outline provides an indication of the likely increase in extent of the more frequent events. The 0.1% AEP event outline covers approximately 16% of the total site area and the extent is localised to area surrounding the Ferry Terminal to east of the site and along the access roads to the north of the site.






0752: Land at Woodside, Chester Street, Birkenhead

Surface Water Flood Risk from Proposed Development

Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for. For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 85% impermeable area and limiting greenfield runoff rate of Qbar (I/s).

Proposed development limiting runoff rate: (I/sec)

Qbar: 56.9 I/s (FEH Statistical)

Q30: 96.73 l/s

Q100: 118.35 l/s

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m ³	Outflow volume m ³	Attenuation required m ³	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	7	4665	1004	3661	25.5	0.244 ha 2.616 %
30yr Rainfall+40%	8.25	5635	1183	4452	31	0.297 ha 3.181 %
100yr Rainfall+20%	8.25	6504	1183	5321 (1660 exceedance storage)	37	0.355 ha 3.802 %
100yr Rainfall+40%	9.5	7783	1362	6421 (1969 exceedance storage)	44.7	0.428 ha 4.588 %
Climate change	Application change anti attenuation	of the centracipated for to volumes for	al (+20%) an the 2080s in t r the 1% AEP	d upper end (+4 he table above s and 3.33% AEP	0%) allowance shows the estim rainfall events.	s for potential nated
Surface water: flood risk impacts from development site, mitigation & SuDS	As part of the central (+20%) and upper end (+40%) anowahces for potential change anticipated for the 2080s in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events. As part of this Level 2 SFRA we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. Attenuation volumes are presented for the critical storm duration for the 3.33% AEP event with exceedance flows quantified up to the 1% event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.					





0752: Land at Woodside, Chester Street, Birkenhead				
	 However, the modelled land raising outputs indicate that land raising could be a viable option for this site without having any significant adverse impacts on the surrounding existing developments. 			
Can the second part of the Exception Test be satisfied?	To pass the Exception Test, it must be proven that the site can be safe for its lifetime, which for residential development is 100 years. The climate change modelling in this Level 2 SFRA shows this will not be possible. However, land raising may be a viable option and should be explored further at the FRA stage.			
FRA requirements	 Investigate land raising option in more detail once potential site layout / design is known. A drainage strategy is required for the proposed new development layout. The FRA should include emergency planning procedures with consideration to safety around the onsite culvert openings and open watercourse and ensuring safe access and egress routes in times of flood. Any FRA should be carried out in line with the NPPF; FRCC-PPG; Local Plan and LLFA policies; and national and local SuDS policy and guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and the emergency services. 			
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Wirral Level 2 Strategic Flood Risk Assessment

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Site 1597

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LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
RFM	Reservoir Flood Map
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
UU	United Utilities
WFD	Water Framework Directive



1597: East of 169 to	187 Pasture Road, Moreton	
Location	Pasture Road, Moreton	
Site area (ha)	1.45	
Watercourse	The Birket / Coastal	
EA Model used	Birket Fender Arrowe Brook Fluvial 2011 and Wirral Tidal 2015	
Existing use	Greenfield	
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable	
Proposed use	Residential	
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable	
Proposed development impermeable area (ha)	1.23	
		_



Figure 1: Existing fluvial and tidal flood zones, and flood risk data

The site is located wholly within Flood Zone 3a with the Flood Map for Planning stating the risk is both fluvial and tidal. The Main River The Birket flows to the south and there are a network of drainage ditches surrounding the site and along the southern and eastern site boundaries. The area of functional floodplain to the south of the site is fluvial and the area to the north is tidal. The site is also within a Flood Warning Area and Flood Alert Area. The entire site is within an ABD from the coastal Wallasey Embankment which is owned and maintained by Wirral Council.



Figure 2: Topography

The elevation across the site fluctuates with areas of higher elevation of approximately 6 mAOD being located towards the edges of the site boundary, the centre being around 5 mAOD and small sections in the west and east with slightly lower elevation of approximately 4 mAOD. The road that runs along the western boundary edge has an elevation of around 4 mAOD and the surrounding drainage ditches having a low elevation of around 3 mAOD.

1597: East of 169 to 187 Pasture Road, Moreton					
Flood Source: Fluvial / Tidal					
Flood Zones	Flood Zone 3b	Flood Zone 3b +climate change*	Flood Zone 3a	Flood Zone 3a +climate change*	Flood Zone 2
	0%	0%	100%	+0%	0%
Fluvial: maximum depth	N/A	N/A	1.4 m	1.0 m^	N/A
Tidal: maximum depth	N/A	N/A	3.3 m	4.3 m	N/A

Flood Zone 3b figures stated based on defended model; Flood Zone 3a and 2 figures stated based on undefended model

*Fluvial climate change figures based on central allowance (+44% on peak flows)

*Tidal climate change figures based on 70th percentile (higher central allowance)

[^]The fluvial climate change max. depth is lower than present day as the baseline present day fluvial scenarios have not been reproduced for this Level 2 SFRA. It is therefore likely that the fluvial depths for the 1% AEP event (Flood Zone 3a) are overestimated





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1597: East of 169 to 187 Pasture Road, Moreton

Modelled fluvial risk including climate change (Birket Fender and Arrowe Brook 2011 model) NOTE: modelled outputs for this SFRA are subtly different to original 2011 modelled outputs due to upgraded modelling and GIS software





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Tidal modelling: modelled land raising

Modelled tidal risk including climate change on the coast with modelled land raising (Wirral Tidal 2018 model)	Given the significant risk exhibited at this site, both in the present day and when accounting for climate change, it was considered necessary to model land raising of the site as a potential mitigation technique to gauge the offsite effects of this. A simple approach was applied whereby the whole site was uplifted to a set value to ensure the whole site was raised out of the flood zone. In reality, the terrain would be gently regraded and reformed to direct displaced water to the most appropriate route. Any FRA for the site should assess this further once site layout options are established.
	The elevation of the site was uplifted by 4.89m to reflect the max levels for the 0.5% + CC (higher central) event +600mm freeboard. The updated maximum elevation within the site boundary has increased to 11.31 mAOD. The extent map indicates the entire site is now protected from flooding when compared to the baseline 0.5% AEP +CC extent in Figure 3.
	Depths to the south of the site behind the embankment are now modelled to be less than the baseline climate change modelling. This is likely to be a result of the raised land at the site and the strip of higher elevation at 326011, 391306 forming a barrier to constrain a large amount of displaced floodwater within site 4022.
	Depths within site 4022 have increased by around 30mm, with the maximum depth having increased to 4.32m from 4.29m. Depths to the east and west of the site remain similar, whereas depths have increased slightly towards the coast, as would be expected. Were land raising to be considered an option at this site then it should be carried out in tandem with Site 4022 to avoid any cumulative impacts displaced water may have on each site and the existing developments.
	Hazard ratings in the area surrounding the site remain at 'Danger for all'.

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1597: East of 169 to	187 Pasture Road, Moreton
	N CASA CASA CASA Contraction Contraction Contraction
	Figure 13: modelled tidal hazards for the 0.5% AEP plus climate change land raising scenario
Historic flooding	There are no areas of historic flooding that affect the site according to the EA's Historic Flood Map (HFM) dataset.
Defences	On the left bank of the southern drainage ditch, which is on the opposing site to the site, there is an embankment that spans the length of the south site boundary which has a design standard of 100 and a condition grade of 3 meaning Fair (Table 1.1 Condition Assessment Manual 2012 ¹). It is not known whether these defences provide any protection to the site. The Wallasey embankment, which is a Council owned coastal embankment, has a design standard of protection of 200 and a condition grade of 2 meaning Good. The SMP policy along the stretch of coast affecting the site is Hold the Line, therefore the long-term strategy is for the defences to be adequately maintained and upgraded to maintain the status quo.
Flood Warning Area	According to the EA's FWA dataset, there are three FWAs in operation that cover the site. One for the River Birket at Leasowe with areas at risk including Pasture

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 $^{1\} https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291126/scho0509bqat-e-e.pdf$





1597: East of 169 to ²	187 Pasture Road, Moreton
Observations, mitigation options & site suitability: tidal	 The proposed use of the site would see a change in the risk classification from less vulnerable to more vulnerable, according to the NPPF. Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the Framework's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development (Para 048 Flood Risk and Coastal Change PPG). The impacts of climate change to this site are modelled to be significant. The entirety of the site is located within tidally and fluvially influenced Flood Zone 3a according to the Flood Map for Planning, however the whole of the site is also within an ABD, which protects the site against present day tidal flooding by way of the Wallasey Embankment. It is not known whether the site is also defended against fluvial flooding. In mapping ABDs, the EA assumes that flood defences and other operating structures act perfective and give the same level of protection as when the structures act perfective and give the same level of protection as when the structures act perfective and give the same level of protection.
	previous assessment of the area was made. Consultation with the LLFA on the condition and maintenance arrangements of the Wallasey Embankment should be carried out however it would be expected, given the SMP policy of 'hold the line' that investment in the defences will continue in the long term.
	 The site is not at residual risk from the present day 0.5% AEP breach scenario of the Wallasey Embankment but in the long term from climate change the whole site is impacted to a maximum depth of 3.4 m and a hazard rating of Danger to All. This breach event highlights the significant risk this site and the north Wirral coastline is at from climate change.
	 Sale access and egress are not considered to be achievable based on the present-day undefended Wirral Tidal 0.5% AEP outline due to total inundation of the A551 to depths of around 2m. However, this site is within an ABD and several flood warnings are in place to evacuate site users of any present-day flood event occurring in the short term.
	- Given the modelled risk from climate change and the difficulties with access and egress routes, it is recommended this site should not be developed for residential use. Ideally, this site would remain for less vulnerable uses with appropriate resilience measures put in place or be cleared and used as a multifunctional greenspace for flood storage, amenity use and to provide environmental/ecological benefits.
	- The modelled land raising scenario indicates raising the levels of the site to the 0.5% AEP +CC maximum level, plus 600mm freeboard, would protect the site from tidal flooding in the long term. The modelled depths to the area immediately surrounding are not significantly impacted by the raising of this site. The low-lying area to the east of the site within the boundary of site 4022 appears to be the most impacted, however this is only an increase of 30mm to the maximum depths. However, raising the site above the required level of 4.69 m would represent a considerable undertaking.
	 Although land raising may be a viable option in protecting the site from tidal flooding, access and egress routes would still need to be available during times of flood, therefore raised escape route options should be investigated. Stilted development may be an option though is likely to be an expensive design solution with access and egress routes also required to be above the design flood level.

A further option may be for ground floor parking or other less vulnerable uses

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1597: East of 169 to 187	Pasture Road, Moreton
	(i.e. non-residential such as shops, restaurants, offices) and for habitable dwellings to be situated on first floor and upwards. However, safe access and egress routes must be available at times of flood, even for above ground floor accommodation.
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1597: East of 169 to	187 Pasture Road, Moreton			
Flood source: infrast	tructure failure – reservoirs (res	idual)		
Flood risk: reservoir	There is no risk of flooding to the site as a result of dam failure, according to the EA's online RFM.			
Flood source: infrast	ructure failure – canals (residua	l)		
Flood risk: canal	There are no canals in the vicinity of this site.			
Flood source: surface	e water			
Surface Water Flo	od Risk to Proposed Devel	opment Site		
Current site: Risk of Flooding from Surface Water map	High Risk (3.3% AEP event)	Medium Risk (1% AEP event)	Low Risk (0.1% AEP event)	
	0%	0%	0.9%	
Surface water max flood depths	Not applicable	Not applicable	0.3 – 0.6 m	





Surface Water map)

* Surface water hazard rating based on Table 4.2 Hazard to People as a Function of Velocity and Depth, R&D OUTPUTS: FLOOD RISKS TO PEOPLE: PHASE 2 FD2321/TR2. Defra. March 2006.

Surface water flood risk to development site	Risk is nominal.
Climate change	The current day 0.1% AEP event outline provides an indication of the likely increase in extent of the more frequent events. The risk remains nominal.

1597: East of 169 to	187 Pasture Ro	ad. Moreton				
Observations, mitigation options & site suitability: surface water	 A drainage strategy would be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. This will require consultation with the LLFA. 					
Surface Water Flo	ood Risk from	n Proposed	d Developmen	t		
Runoff rates should aimed for. For the calculated below ba (I/s).	I not exceed cu purposes of th ased on an assi	irrent rates is assessm umed 85%	and if possible ent, the require impermeable a	e, betterment of ed volumes of a rea and limiting	existing rates ttenuation hav g greenfield rui	should be e been hoff rate of Qbar
Proposed developm Qbar: 4.71 l/s (assu Q30: 8.01 l/s Q100: 9.8 l/s	ent limiting rur ume 5 I/s minir	noff rate: (I num discha	/sec) arge) (FEH Stat	istical)		
Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volum e m ³	Outflow volume m ³	Attenuation required m ³	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
3.33% AEP Rainfall + 20%	12	826	151	675	53.4	0.045 ha 3.103 %
3.33% AEP Rainfall + 40%	12	964	151	813	64.3	0.054 ha 3.738 %
1% AEP Rainfall + 20%	12*	1096	151	945 (270 exceedance storage)	74.8	0.063 ha 4.345 %
1% AEP Rainfall + 40%	12*	1279	151	1128 (315 exceedance storage)	89.3	0.075 ha 5.186 %
*limited to a 12hr of	critical storm			-		•
Climate change	Application of change antion attenuation	Application of the central (+20%) and upper end (+40%) allowances for potential change anticipated for the 2080s in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.				
Surface water: flood risk impacts from development site, mitigation & SuDS	As part of th land take if a developmen Attenuation AEP event w developmen managed on	iis Level 2 s a pond with t. volumes ar ith exceeda t worsening site.	SFRA we have in an assumed d re presented for ance flows quar g flood risk else	ncluded calculat epth of 1.5m wa the critical stor ntified up to the where, surface	tions to provide as included as rm duration fo 1% event. To water runoff m	e an estimated part of the r the 3.33% o prevent nust be

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1597: East of 169 to 187 Pasture Road, Moreton			
Recommendation summary	 Based on the evidence presented in the Level 1 SFRA and this Level 2 SFRA: Early discussions should take place with the EA with regards to the tidal and fluvial flood risk issues on this site. The EA offers early engagement through an advisory service via their website (https://www.gov.uk/guidance/developers-get-environmental-advice-on-your-planning-proposals) or by emailing the local office: SPPlanning.RFH@environment-agency.gov.uk. This site should not be developed for residential use. Ideally, this site would remain for less vulnerable uses with appropriate resilience measures put in place or be used as a multifunctional greenspace for flood storage, amenity use and to provide environmental/ecological benefits. However, land raising could be a viable option to protect the site from tidal flooding. Displaced floodwater is modelled to naturally divert to the low-lying area of land to the west of the site (though into Site 4022) and towards the coast to the north. Displaced floodwater should be diverted along the west of site to direct floodwater towards the northern coastline and protect the existing development from increased risk as a result of land raising across the site. The embankment to the south of the site is modelled to protect land to the south. Site 4022 should be considered in any future mitigation plans for this site. Any consideration for development must fully investigate the options presented in this Level 2 SFRA, including for the provision of safe access and 		
Can the second part of the Exception Test be satisfied?	To pass the Exception Test, it must be proven that the site can be safe for its lifetime, which for residential development is 100 years. The modelling in this Level 2 SFRA shows this will not be possible. However, land raising may be a viable option and should be explored further at the FRA stage.		
FRA requirements	 Raised escape route and displaced floodwater diversion options should be investigated alongside land raising. This should be carried out in tandem with the development of adjacent Site 4022. For development to proceed, the FRA must show the development can be safe for its lifetime and must not increase risk elsewhere. Any FRA should be carried out in line with the NPPF; FRCC-PPG; Local Plan and LLFA policies; and national and local SuDS policy and guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and the emergency services. 		
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Wirral Level 2 Strategic Flood Risk Assessment

JBA

Site 1895

Final Report

February 2022

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Revision History

Revision Ref/Date	Amendments	Issued to
V1.0 Draft September 2021	-	John Entwistle
V2.0 Draft December 2021	Council and EA comments addressed	John Entwistle
V2.0 Final February 2022		John Entwistle

Prepared by	Hannah Bishop BSc MSc
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Purpose

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Abbreviations

AOD	Above Ordnance Datum
BGS	British Geological Survey
EA	Environment Agency
FRCC-PPG	Flood Risk and Coastal Change Planning Practice Guidance
FMfP	Flood Map for Planning
FAA	Flood Alert Area
FRA	Flood Risk Assessment
FWA	Flood Warning Area
HFM	Historic Flood Map
LIDAR	Light Detection and Radar
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
RFM	Reservoir Flood Map
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
UU	United Utilities
WFD	Water Framework Directive



1895: Land and Marii	ne Depot, Dock Road North	
Location	Dock Road North, Bromborough Pool	
Site area (ha)	3.51	
Watercourse	Dibbinsdale Brook	
EA Model used	Mersey Estuary 2018	
Existing use	Former dockland and brownfield	
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable	
Proposed use	Residential	
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable	
Proposed development impermeable area (ha)	2.98	


The Main River Dibbinsdale Brook flows along the southern boundary edge of the site before flowing into the Mersey Estuary to the east. The site remains free from Flood Zone 3b, which is confined to the channel of Dibbinsdale Brook, however there is a large area of Flood Zone 3a in the central and southern areas of the site. According to the Flood Map for Planning, the Flood Zone 3a risk to the site is tidal. A FWA is in place in the south and centre of the site covering the majority of the Flood Zone 3a area. There are a number of FAAs within the site and to the south covering flooding from Dibbinsdale Brook.



Figure 2: Topography

The elevation does not vary substantially across the site. The topography generally slopes eastwards from higher ground of approximately 9.5 m AOD to the west where it declines to around 6.7 m AOD. There is an area of high ground to the north east of the site where there is substantially higher elevation of approximately 25 m AOD which declines gradually to reach the site.

1895: Land and Marine Depot, Dock Road North					
Flood Source: Tidal					
Flood Zones	Flood Zone 3b	Flood Zone 3b +climate change*	Flood Zone 3a	Flood Zone 3a +climate change*	Flood Zone 2
	0.0%	+70.9%	34.9%	+47.2%	23.6%
Tidal: maximum depth	Not available	0.9 m	N/A	1.5 m	Not available

Flood Zone 3b figures stated based on defended model; Flood Zone 3a and 2 figures stated based on undefended model

*Climate change figures based on higher central allowance (70th percentile)



1895: Land and Marine Depot, Dock Road North

to the site at this stage. This explains why Flood Zone 3a, shown in Figure 1, is different to the 0.5% AEP event shown above in Figure 3. The majority of the present-day tidal risk to the site comes from Dibbinsdale Brook and therefore the Dibbinsdale Brook model. The risk shown in Figure 3 is therefore an underestimate.





1895: Land and Marine Depot, Dock Road North OA. 1895 Legend Site boundary Main Rivers 0.5% AEP +CC ZUK0 hazard ratings Very low hazard RES-SA4.6 Danger for some Danger for most Danger for all Metres 100 150 200 50 Contains Ordhance Survey data © Crown copyright and database right [2021] Figure 6: modelled tidal flood hazard for 0.5% AEP +climate change event * Tidal hazard ratings based on Table 4 of the SUPPLEMENTARY NOTE ON FLOOD HAZARD RATINGS AND THRESHOLDS FOR DEVELOPMENT PLANNING AND CONTROL PURPOSE - Clarification of the Table 13.1 of FD2320/TR2 and Figure 3.2 of FD2321/TR1. May 2008. This site will be significantly impacted by flooding in the long term due to climate change. Maximum depths reach 1.5m and 'Danger for Most' is the predominant hazard rating. It is also evident from Figure 4 that the functional floodplain could

impact the site in the long term with 71% of the site at risk from a 4% AEP tidal

event plus climate change.

1895: Land and Marine Depot, Dock Road North

Tidal modelling: modelled land raising

Modelled tidal risk including climate change on the coast with modelled land raising (Mersey Estuary 2018 model)	Given the significant risk exhibited at this site when accounting for climate change, it was considered necessary to model land raising of the site as a potential mitigation technique to gauge the offsite effects of this. A simple approach was applied whereby the whole site was uplifted to a set value to ensure the whole site was raised out of the flood zone. In reality, the terrain would be gently regraded and reformed to direct displaced water to the most appropriate route. Any FRA for the site should assess this further once site layout options are established. The elevation of the site was uplifted by 2.97 m to reflect the maximum levels for the 0.5% + CC (higher central) event +600 mm freeboard, as recommended by the EA. The updated maximum elevation within the site boundary therefore increased
	to 12.42 mAOD. Figure 7 shows the entire site to be flood free when compared to the baseline 0.5% AEP +CC extent in Figure 4.
	As a result of land raising, modelled depths to the north and east of the site have decreased when compared to the baseline climate change event. This is beneficial to the existing industrial development located adjacent to Dock Road North, where depths are around 60mm lower. Depths have also decreased by around 20mm within the boundary of site RES-SA4.6.
	The decrease in depths is likely due to the artificially raised land within the site boundary and the raised elevation to the east forcing displaced floodwater into Dibbinsdale Brook, which has ponded within the area of lower elevation to the west of New Chester Road. Depths within this area have increased in the land raising scenario compared to the baseline.
	Hazard ratings in the area surrounding the site remain largely similar due to the very small changes in depth.

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1895: Land and Marine Depot, Dock Road North			
	<figure></figure>		
Historic flooding	There are no areas of historic flooding that affect the site according to the EA's Historic Flood Map (HFM) dataset.		
Defences	There is no known flood defence infrastructure in the vicinity of the site.		
Flood Warning Area	According to the EA's FWA dataset, there is a FWA covering a large portion of the site in the south and centre for the Irish Sea and Mersey Estuary from the Head of the Wirral to Runcorn.		

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JRA

1895: Land and Marii	ne Depot, Dock Road North		
	 site would remain for put in place or be clea storage, amenity use Land raising may be modelled land raising 0.5% AEP +CC maxin site from tidal floodin site have been mode the required level of Stilted development design solution with design flood level. A further option may (i.e. non-residential dwellings to be situat egress routes must b accommodation A flood risk activity p of Dibbinsdale Brook available from the EA 8m of any watercours 	less vulnerable uses with ap ared and be used as a multifu- and to provide environment a viable option to tackle tida g scenario indicates raising the mum level, plus 600mm free ing in the long term. Depths lled to have decreased. How 2.97 m would represent a con- may be an option though access and egress routes a be for ground floor parking such as shops, restaurants and the art times of flood permit may be required as the con- taction obtaining a Fl a. The EA would also recom- se to allow for access for ma-	propriate resilience measures unctional greenspace for flood tal/ecological benefits. I flood risk at this site. The ne levels of the site to the board, would protect the to the area surrounding the vever, raising the site above onsiderable undertaking. is likely to be an expensive lso required to be above the or other less vulnerable uses s, offices) and for habitable s. However, safe access and , even for above ground floor he development is within 8m ood Risk Activity Permit are mend no development within intenance purposes.
Flood source: infrast	ructure failure – reservoirs (res	idual)	
Flood risk: reservoir	There is no risk of flooding EA's online RFM.	to the site as a result of dam	n failure, according to the
Flood source: infrast	ructure failure – canals (residua	l)	
Flood risk: canal	There are no canals in the v	icinity of the site.	
Flood source: surface	e water		
Surface Water Flo	od Risk to Proposed Devel	opment Site	
Current site: Risk of Flooding from Surface Water map	High Risk (3.3% AEP event) 3.3%	Medium Risk (1% AEP event) 9.5%	Low Risk (0.1% AEP event) 29.1%
Surface water max flood depths	0.3 – 0.6 m	0.3 - 0.6 m	0.3 - 0.6 m





Surface water flood risk to development site	Approximately 10% of the site is at risk of surface water flooding in the 1% AEP event to a maximum depth of between 0.3 and 0.6 m and with areas of low and moderate hazard. The risk in all events is primarily localised to the south east and north east corners of the site and is constrained by current buildings which will most likely be demolished.
	Safe access and egress would be achievable via Dock Road North to the north west of the site as it is only partially inundated with maximum depths of up to 0.15 m with a low hazard rating, and the unnamed small road on site in the north west corner.



IRA

ne Depot, Dock I	Road North				
Consultation with the LLFA should be carried out to confirm surface water drainage arrangements.					
od Risk from	Proposed	l Developmen	t		
not exceed cur purposes of thi sed on an assu	rrent rates s assessm med 85%	and if possible ent, the require impermeable a	, betterment of ed volumes of at rea and limiting	existing rates tenuation hav greenfield rur	should be e been hoff rate of Qbar
ent limiting run I Statistical)	off rate: (I	/sec)			
Critical storm duration Hrs	Inflow volum e m ³	Outflow volume m ³	Attenuation required m ³	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
7.75	1826	397	1429	27.8	0.095 ha 2.714 %
9	2199	461	1738	33.9	0.116 ha 3.301 %
9.25	2543	474	2069 (640 exceedance storage)	40.3	0.138 ha 3.930 %
10.5	3036	538	2498 (760 exceedance storage)	48.7	0.167 ha 4.745 %
Application of the central (+20%) and upper end (+40%) allowances for potential change anticipated for the 2080s in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.					
As part of thi land take if a development Attenuation v AEP event wi development managed on	s Level 2 S pond with volumes ar th exceeda worsening site.	SFRA we have i an assumed d e presented for ance flows quar flood risk else	ncluded calculat epth of 1.5m wa the critical stor ntified up to the where, surface	ions to provide as included as m duration for 1% event. To water runoff m	e an estimated part of the f the 3.33% o prevent oust be
	Pepot, Dock I Consuldraina cod Risk from not exceed curporposes of thi port limiting run 1 Statistical) Critical storm duration Hrs 7.75 9 9.25 10.5 Application of change anticiattenuation v As part of thi land take if a development Attenuation v Attenuation v AEP event wi development managed on	PerformConsultation with drainage arrangeCond Risk from Proposednot exceed current ratespurposes of this assessmesed on an assumed 85%ent limiting runoff rate: (I 4 Statistical)Critical storm duration HrsInflow volum e m³7.751826921999.25254310.53036Application of the centr change anticipated for attenuation volumes for As part of this Level 2 S land take if a pond with development.Attenuation volumes ar AEP event with exceedad development worsening managed on site.	Pe Depot, Dock Road North Consultation with the LLFA shoudrainage arrangements. Cod Risk from Proposed Development not exceed current rates and if possible purposes of this assessment, the require sed on an assumed 85% impermeable a ent limiting runoff rate: (I/sec) 4 Statistical) Critical storm duration Hrs 1 Inflow volum e m³ 7.75 1826 9 2199 461 9.25 2543 474 10.5 3036 538 Application of the central (+20%) and change anticipated for the 2080s in th attenuation volumes for the 1% AEP a As part of this Level 2 SFRA we have i land take if a pond with an assumed d development. Attenuation volumes are presented for AEP event with exceedance flows quart development worsening flood risk else managed on site.	Depot, Dock Road North Consultation with the LLFA should be carried oudrainage arrangements. and Risk from Proposed Development not exceed current rates and if possible, betterment of purposes of this assessment, the required volumes of at seed on an assumed 85% impermeable area and limiting ent limiting runoff rate: (I/sec) 4 Statistical) Critical statistical Critical statistical Inflow volum em³ Quarter of this assessment, the required volumes of at seed on an assumed 85% impermeable area and limiting Critical statistical) Critical statistical Quarter of this assessment, the required volume m³ Parter of this em³ Volume m³ P 9 2199 461 1738 9.25 2543 474 2069 (640 exceedance storage) 10.5 3036 538 2498 (760 exceedance storage) 10.5 3036 538 Application of the central (+20%) and upper end (+40 change anticipated for the 2080s in the table above stattenuation volumes for the 1% AEP and 3.33% AEP r As part of this Level 2 SFRA we have included calculat land take if a pond with an assumed depth of 1.5m wad evelopment. Attenuation vo	Peppot, Dock Road North Consultation with the LLFA should be carried out to confirm stationing a arrangements. Prod Risk from Proposed Development Not exceed current rates and if possible, betterment of existing rates purposes of this assessment, the required volumes of attenuation hav seed on an assumed 85% impermeable area and limiting greenfield run ent limiting runoff rate: (I/sec) Statistical) Critical statistical Inflow volum end end Volum end end Volum end end P 2199 461 1738 33.9 9.25 2543 474 2069 (640 exceedance storage) 10.5 3036 538 2498 (760 exceedance storage) 10.5 3036 538 2498 (760 exceedance storage) Application of the central (+20%) and upper end (+40%) allowance change anticipated for the 2080s in the table above shows the estim attenuation volumes for the 1% AEP and 3.33% AEP rainfall events. As part of this Level 2 SFRA we have included calculations to provide land take if a pond with an assumed depth of 1.5m was included as development.

1895: Land and Marine Depot, Dock Road North Flood Source: Groundwater Flood risk: groundwater Legend 1895 boundary Other sites Main Rivers Groundwater risk CLASS Limited potential for ground water flooding to occur E'S Potential for Bromborough Po ground water flood in a of property situated below oround level Potential for oround water flood in g to occur at surface 210 contains Ordnance Survey data © Crown copyright and database right [2021] Figure 14: Susceptibility of groundwater flooding (BGS national dataset) Based on geological and hydrogeological information, the BGS dataset can be used to identify areas where geological conditions could enable groundwater flooding to occur and where groundwater may come close to the ground surface. The dataset should not be used on its own to make planning decisions at any scale and should not be used to inform planning decisions at the site scale. The susceptibility data cannot be used on its own to indicate risk of groundwater flooding. The dataset shows that most of the site is not prone to groundwater flooding with some sections towards the west and north east corner of the site where there is potential for groundwater flooding to property situated below ground level. Any development plans should therefore further investigate ground conditions before planning the construction of any basements or below ground car parking.

IRA



1895: Land and Marin	ne Depot, Dock Road North
Overall Site Assessm	nent
Access and egress	 Safe access and egress is modelled to be achievable via Dock Road North in the west of the site in the long term.
Recommendation summary	 Based on the evidence presented in the Level 1 SFRA and this Level 2 SFRA: Early discussions should take place with the EA with regards to the tidal flood risk issues on this site. The EA offers early engagement through an advisory service via their website (https://www.gov.uk/guidance/developers-get-environmental-advice-on-your-planning-proposals) or by emailing the local office: SPPlanning.RFH@environment-agency.gov.uk. It is recommended that this site should not be developed for residential use given the significant long-term risk from climate change. The site should remain for less vulnerable uses with resilience measures in place or alternatively cleared for open space and converted to multifunctional amenity greenspace providing flood storage and social and environmental benefits. However, the modelled land raising outputs indicate that land raising could be a viable option for this site without having any significant adverse impacts on the surrounding existing developments No development within 8 m of the EA Main River Dibbinsdale Brook. Given that there is potential for groundwater flooding to property below ground level across the south and eastern extent of the site, it is recommended that no subsurface development is permitted. This assessment could be revisited once the Dibbinsdale Brook model has been updated. However, it is likely that risk will be further exacerbated by risk from Dibbinsdale Brook. Any consideration for development must fully investigate the options presented in this Level 2 SFRA.
Can the second part of the Exception Test be satisfied?	To pass the Exception Test, it must be proven that the site can be safe for its lifetime, which for residential development is 100 years. The climate change modelling in this Level 2 SFRA shows this will not be possible. However, land raising may be a viable option and should be explored further at the FRA stage.
FRA requirements	 For development to proceed, the FRA must show the development can be safe for its lifetime and must not increase risk elsewhere. Investigate land raising option in more detail once potential site layout / design is known. The FRA should include a drainage strategy for the proposed new development layout. The FRA should include emergency planning procedures with consideration to ensuring safe access and egress routes in times of flood. Any FRA should be carried out in line with the NPPF; FRCC-PPG; Local Plan and LLFA policies; and national and local SuDS policy and guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and the emergency services.
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Wirral Level 2 Strategic Flood Risk Assessment

JBA

Site 4022

Final Report

February 2022

www.jbaconsulting.com



JBA Project Manager

Mike Williamson JBA Consulting Second Floor Phoenix House Lakeside Drive Centre Park Warrington WA1 1RX

Revision History

Revision Ref/Date	Amendments	Issued to
V1.0 Draft September 2021	-	John Entwistle
V2.0 Draft December 2021	Council and EA comments addressed	John Entwistle
V2.0 Final February 2022		John Entwistle

Prepared by	Laura Thompson BSc
	Assistant Analyst
Reviewed by	Mike Williamson BSc MSc CGeog FRGS EADA
	Principal Flood Risk Analyst

Purpose

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Abbreviations

AOD	Above Ordnance Datum
BGS	British Geological Survey
EA	Environment Agency
FRCC-PPG	Flood Risk and Coastal Change Planning Practice Guidance
FMfP	Flood Map for Planning
FAA	Flood Alert Area
FRA	Flood Risk Assessment
FWA	Flood Warning Area
HFM	Historic Flood Map
LIDAR	Light Detection and Radar
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
RFM	Reservoir Flood Map
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
UU	United Utilities
WFD	Water Framework Directive



4022: Land at Pastur	e Road/Leasowe Road	
Location	Moreton, Greasby, Wirral	
Site area (ha)	5.3	
Watercourse	The Birket / Coastal	
EA Model used	Wirral Tidal 2015 model / Birket Fender Arrow Brook Fluvial model 2011	
Existing use	Greenfield	
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable	
Proposed use	Residential	
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable	
Proposed development impermeable area (ha)	4.51	



Figure 1: Existing fluvial and tidal flood zones, and flood risk data

The entirety of the site lies within both fluvial and tidal Flood Zone 3a, according to the Flood Map for Planning. The area of functional floodplain to the south of the site is fluvial and the area to the north is tidal. Three FWAs are in place impacting the whole site. Two FAAs are present across the site. The **whole site lies within the EA's 'Areas Benefitting from Defences' polygon**, which shows the areas protected against tidal flooding by the Wallasey Embankment. There are several field drains/ditches running through the site.



Figure 2: Topography

The elevation does not vary substantially across the site. The site is generally low-lying, sloping from the north eastern boundary of the site (approx. 4 mAOD) down towards the southern and western site boundaries, at around 3 mAOD.



4022: Land at Pasture Road/Leasowe Road Flood Source: Fluvial and Tidal Flood Zones Flood Zone 3b Flood Zone Flood Zone Flood Zone 3a Flood Zone 2 3b +climate 3a +climate change* change* 0% +0% 100% 0% +0% Fluvial: maximum N/A N/A 1.4 m 1.1 m^ N/A depth Tidal: maximum N/A N/A N/A 3.31 m 4.29 m depth

All figures stated based on undefended model

*Fluvial climate change figures based on central allowance (+44% on peak flows). Tidal climate change figures based on 70th percentile (higher central allowance)

[^]The fluvial climate change max. depth is lower than present day as the baseline present day fluvial scenarios have not been reproduced for this Level 2 SFRA. It is therefore likely that the fluvial depths for the 1% AEP event (Flood Zone 3a) are overestimated

Modelled fluvial risk including climate change on The Birket (Birket Fender and Arrowe Brook 2011 model) NOTE: modelled outputs for this SFRA are subtly different to original 2011 modelled outputs due to upgraded modelling and GIS software



Figure 3: modelled fluvial flood depths for 1% AEP baseline event











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4022: Land at Pastur	re Road/Leasowe Road
	Legend 107 Osf MEP+CC ZIKO hazard rating 100 Osf MEP+CC ZIKO hazard rating 1
	hazard ratings for 0.5% AEP plus climate change event The Wallasey Embankment breach modelling outputs show that there is significant residual risk to the site during the 0.5% AEP plus climate change event. Maximum depths within the site boundary reach 3.4 m and hazards are 'danger for all'. Although the modelling outputs show significant risk in the long term, the Shoreline Management Plan strategy on this section of coastline is to hold the line. Given the large area of Wirral at risk from such a breach of the Wallasey Embankment, it is unlikely that Wirral Council would cease funding for maintenance and defence improvements into the future.
Historic hooding	the site.
Defences	There are ten flood embankment structures within the vicinity of the site, primarily located to the south and west. The southern embankments, and four flood wall structures, are situated along the banks of The Birket. The whole site lies within the EA's 'Areas Benefitting from Defences' polygon, protected by the Wallasey Embankment along the north coast of the Wirral.
Flood Warning Area	According to the EA's FWA dataset, there are three FWAs in operation across the entirety of the site for the River Birket, the coastline at the Head of the Wirral and for the Irish Sea and Mersey Estuary. These affect a number properties across Moreton and Leasowe.
2021s1045 Wirra	I Level 2 SFRA - Site 4022 v2.0 16

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4022: Land at Pasture Road/Leasowe Road

Natural Flood Management / Working with Natural Process According to the national scale 'potential for WwNP dataset', there is the potential for flood alleviation of slowing the flow through riparian woodland planting of large areas in and around the site.



Figure 16: Areas identified as potential for riparian woodland and floodplain reconnection (Working with Natural Processes)





Figure 17: 0.1% AEP event surface water flood depths (Risk of Flooding from Surface Water map)



Figure 18: 0.1% AEP event surface water flood hazards (Risk of Flooding from Surface Water map)

* Surface water hazard rating based on Table 4.2 Hazard to People as a Function of Velocity and Depth, R&D OUTPUTS: FLOOD RISKS TO PEOPLE: PHASE 2 FD2321/TR2. Defra. March 2006.

Surface water flood risk to development site	There is minimal surface water risk to the site in the 1% AEP event.
Climate change	The current day 0.1% AEP event outline provides an indication of the likely increase in extent of the more frequent events. Approximately 27% of the site is at risk of surface water flooding in the 0.1% AEP event to a maximum depth between 0.3 to 0.6 m, and with areas of low to moderate hazard. The risk in the 0.1% AEP event is spread across the site, primarily located towards the southern boundary and the central areas of the site

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4022: Land at Pastur	e Road/Leasow	e Road					
	towards the land. Safe access/ a surface wa	towards the northern and western boundaries. The land here is low-lying greenfield land. Safe access/egress should still be possible via Leasowe Road and Mereheath during a surface water flood event.					
Observations, mitigation options & site suitability: surface water	- A full drainage strategy would be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. This will require surface water modelling based on proposed layout plans. Full consultation with the LLFA will be important at this site.						
Surface Water Flo	ood Risk from	Proposec	l Developmen	t			
Runoff rates should aimed for. For the calculated below ba (I/s).	not exceed cu purposes of thi ised on an assu	rrent rates s assessmo imed 85%	and if possible ent, the require impermeable a	e, betterment of ed volumes of a rea and limiting	existing rates ttenuation hav greenfield rur	should be e been hoff rate of Qbar	
Proposed developme Obar: 17.25 l/s (FEF Q30: 29.33 l/s Q100: 35.89 l/s	ent limiting run H Statistical)	off rate: (I	/sec)				
Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volum e m ³	Outflow volume m ³	Attenuation required m ³	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area	
30yr Rainfall+20%	12	3029	522	2507	57.5	0.167 ha 3.148 %	
30yr Rainfall+40%	12	3534	522	3012	69.1	0.201 ha 3.782 %	
100yr Rainfall+20%	12*	4019	522	3498 (991 exceedanc e storage)	80.2	0.233 ha 4.392 %	
100yr Rainfall+40%	12*	4689	522	4168 (1156 exceedanc e storage)	95.6	0.278 ha 5.233 %	
Climate change	Application of the central (+20%) and upper end (+40%) allowances for potential change anticipated for the 2080s in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.						
Surface water: flood risk impacts from development site, mitigation & SuDS	attenuation volumes for the 1% AEP and 3.33% AEP rainfall events. As part of this Level 2 SFRA we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. Attenuation volumes are presented for the critical storm duration for the 3.33% AEP event with exceedance flows quantified up to the 1% event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.						





4022: Land at Pasture	4022: Land at Pasture Road/Leasowe Road				
	 your-planning-proposals) or by emailing the local office: SPPlanning.RFH@environment-agency.gov.uk. This site should not be developed for residential use. Ideally, this site would remain for less vulnerable uses with appropriate resilience measures put in place or be cleared and used as a multifunctional greenspace for flood storage, amenity use and to provide environmental/ecological benefits. Any consideration for development must fully investigate the options presented in this Level 2 SFRA, including for the provision of safe access and egress routes. 				
Can the second part of the Exception Test be satisfied?	No. To pass the Exception Test, it must be proven that the site can be safe for its lifetime, which for residential development is 100 years. The modelling in this Level 2 SFRA shows this will not be possible.				
FRA requirements	 For development to proceed, the FRA must show the development can be safe for its lifetime and must not increase risk elsewhere. Any FRA should be carried out in line with the NPPF; FRCC-PPG; Local Plan and LLFA policies; and national and local SuDS policy and guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and the emergency services. 				
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Wirral Level 2 Strategic Flood Risk Assessment

JBA

Site 4081

Final Report

February 2022

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Revision History

Revision Ref/Date	Amendments	Issued to	
Draft v1.0 September 2021	-	John Entwistle	
V2.0 Draft December 2021	Council and EA comments addressed	John Entwistle	
V2.0 Final February 2022		John Entwistle	

Prepared by	Maria Botterill BSc
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Reviewed by	Mike Williamson BSc MSc CGeog FRGS EADA
	Principal Flood Risk Analyst

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Abbreviations

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FMfP	Flood Map for Planning
FAA	Flood Alert Area
FRA	Flood Risk Assessment
FWA	Flood Warning Area
HFM	Historic Flood Map
LIDAR	Light Detection and Radar
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
RFM	Reservoir Flood Map
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
UU	United Utilities
WFD	Water Framework Directive



4081: Birkenhead Le	4081: Birkenhead Leisure Centre Europa Boulevard				
Location	Birkenhead				
Site area (ha)	1.57				
Watercourse	Mersey Estuary				
EA Model used	Mersey Estuary 2018 Model				
Existing use	Commercial – leisure centre				
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable				
Proposed use	Residential				
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable				
Proposed development impermeable area (ha)	1.33				



This site is fully within Flood Zone 1 according to the Flood Map for Planning.



Figure 2: Topography

The elevation does not vary substantially across the site. There is a slight slope down in topography generally from the south (approximately 7m AOD) to the north (approximately 6m AOD).

Flood Source: Tidal							
Flood Zones	Flood Zone 3b	Flood Zone 3b +climate change*	Flood Zone 3a	Flood Zone 3a +climate change*	Flood Zone 2		
	0%	+0%	0%	+37%	0%		
Tidal: maximumN/AN/AN/A0.66 mN/AdepthN/AN/AN/AN/AN/AN/A							
All figures stated based on undefended model							
*Climate change figures based on 70th percentile (higher central allowance)							

4081: Birkenhead Leisure Centre Europa Boulevard

Modelled tidal risk including climate change (Mersey Estuary 2018 model) NOTE: modelled outputs for this SFRA are subtly different to original 2018 modelled outputs due to upgraded modelling and GIS software



Figure 3: modelled tidal flood outlines for 0.5% AEP plus higher central climate change allowance

Note: Modelled baseline flood extents for the 0.5% AEP event vary from the existing Flood Zone 3a outlines. This is a result of the existing flood zones using the old Coastal Flood Boundaries (CFB) from 2011 and the model having a base year of 2015. The previous CFB excluded data from the Class A gauge at Liverpool due to differences with the surrounding gauges at Heysham and Hilbre Island. The new CFB in 2018 included gauge data from Liverpool and an uplift was added to get the model to a base year of 2021, meaning the levels at the mouth of the estuary increased by over 0.3m causing additional flooding to certain areas.

The current Flood Map for Planning therefore underestimates present day tidal flood risk to the Wirral, hence why the Flood Map for Planning (Figure 1) shows the site to be in Flood Zone 1. The tidal models should be updated with the new CFB data. As more recent data is available which hasn't been built into the flood zones, a precautionary approach should be adopted pending the updating of the tidal models and subsequent updates to the Flood Map for Planning.







4081: Birkenhead Leisure Centre Europa Boulevard

Observations, mitigation options & site suitability: tidal	 The proposed use of development would see a change in risk classification from less vulnerable to more vulnerable according to the NPPF. Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the Framework's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development (Para 048 Flood Risk and Coastal Change PPG). The site is entirely within Flood Zone 1 according to the Flood Map for Planning. However, the Mersey Estuary 0.5% AEP event +CC outputs indicate that 37% of the site is at risk of tidal flooding in the future, with depths across the site reaching a maximum level of 0.66 m. A large proportion (63%) of the site is still developable and not modelled to be at risk from climate change. Development should be directed to the area outside of the climate change risk area. Safe access and egress routes must be available at all times and this appears 					
Flood source: infrast	ructure failure – reservoirs (res	idual)				
Flood risk: reservoir	There is no risk of flooding t EA's online RFM.	to the site as a result of dam	failure, according to the			
Flood source: infrast	ructure failure – canals (residua	I)				
Flood risk: canal	There are no canals in the vicinity of this site.					
Flood source: surface	e water					
Surface Water Flood Risk to Proposed Development Site						
Current site: Risk of Flooding from Surface Water man	High Risk (3.3% AEP event) 2.5%	Medium Risk (1% AEP event) 11.6%	Low Risk (0.1% AEP event) 39.4%			
Surface water max flood depths	0.3 - 0.6m 0.3 - 0.6m 0.9 - 1.2m					





Figure 6: 1% AEP event surface water flood depths (Risk of Flooding from Surface Water map)





Figure 7: 1% AEP event surface water flood hazards (Risk of Flooding from Surface Water map)

*Surface water hazard rating based on Table 4.2 Hazard to People as a Function of Velocity and Depth, R&D OUTPUTS: FLOOD RISKS TO PEOPLE: PHASE 2 FD2321/TR2. Defra. March 2006.

Surface water flood risk to development site	Approximately 12% of the site is at risk of surface water flooding in the 1% AEP event to a maximum depth of between 0.3 and 0.6m and with a small area of moderate hazard on the western boundary. The surface water risk is constrained and dictated by the current building. Safe access and egress may be achievable via Beckwith Street East to the northwest or alternatively via Clwyd Street to the A553 where depths are shallow and hazards are low in the 1% AEP event.
Climate change	The current day 0.1% AEP event outline provides an indication of the likely increase in extent of the more frequent events. The 0.1% AEP event outline covers almost 40% of the total site area and the extent is localised to the north and west of the site, surrounding the current development that exists within the site boundary. Clwyd Street to the south becomes partially inundated during a 0.1% AEP surface water flood event, but as depths range between 0.15 and 0.30 m, safe access and egress via this road should remain viable.







4081: Birkenhead Leisure Centre Europa Boulevard

Surface Water Flood Risk from Proposed Development

Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for. For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 85% impermeable area and limiting greenfield runoff rate of Qbar (I/s).

Proposed development limiting runoff rate: (I/sec)

Qbar: 8.89 I/s (FEH Statistical)

Q30: 15.11 l/s

Q100: 18.49 I/s

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volum e m ³	Outflow volume m ³	Attenuation required m ³	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	7.5	798	168	630	28	0.042 ha 2.675 %
30yr Rainfall+40%	8.75	962	196	766	34.1	0.051 ha 3.253 %
100yr Rainfall+20%	8.75	1107	196	911 (281 exceedanc e storage)	40.5	0.061 ha 3.868 %
100yr Rainfall+40%	10.25	1328	230	1099 (333 exceedanc e storage)	48.9	0.073 ha 4.667 %
Climate change	Application o change antic attenuation v	f the centra pated for t olumes for	al (+20%) and the 2080s in the r the 1% AEP at	upper end (+4 e table above s nd 3.33% AEP	0%) allowance hows the estim rainfall events.	s for potential nated
Surface water: flood risk impacts from development site, mitigation & SuDS	As part of this Level 2 SFRA we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. Attenuation volumes are presented for the critical storm duration for the 3.33% AEP event with exceedance flows quantified up to the 1% event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.					e an estimated part of the the 3.33% prevent oust be



4081: Birkenhead Leisure Centre Europa Boulevard				
	 Development should avoid the north western region of the site at long-term risk of climate change if land raising is not an option for this area. This area should instead be used as multifunctional greenspace, or for less vulnerable development such as ground floor parking. Given the risk of groundwater flooding to property below ground level, all development should be above ground level. A full drainage strategy should be carried out and consulted upon with the LLFA. 			
Can the second part of the Exception Test be satisfied?	Site not subject to the Exception Test though development may be permitted assuming it can be shown that surface water and long-term tidal flood risk can be mitigated effectively onsite and included within the site design. If not, development of this site should not be permitted.			
FRA requirements	 Options for land raising could be assessed and modelled for any development planned in Flood Zone 3a +climate change. The FRA should include a drainage strategy for the proposed new development layout. Consultation with the LLFA should be carried out on surface water drainage arrangements. Any FRA should be carried out in line with the NPPF; FRCC-PPG; Local Plan and LLFA policies; and national and local SuDS policy and guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and the emergency services. 			
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Wirral Level 2 Strategic Flood Risk Assessment

JBA

Site EMP-RA3.1

Final Report

February 2022

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JBA Project Manager

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Revision History

Revision Ref/Date	Amendments	Issued to
V1.0 Draft September 2021	-	John Entwistle
V2.0 Draft December 2021	Council and EA comments addressed	John Entwistle
V2.0 Final February 2022		John Entwistle

Prepared by	Hannah Bishop BSc MSc
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	Principal Flood Risk Analyst

Purpose

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Abbreviations

AOD	Above Ordnance Datum
BGS	British Geological Survey
EA	Environment Agency
FRCC-PPG	Flood Risk and Coastal Change Planning Practice Guidance
FMfP	Flood Map for Planning
FAA	Flood Alert Area
FRA	Flood Risk Assessment
FWA	Flood Warning Area
HFM	Historic Flood Map
LIDAR	Light Detection and Radar
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
RFM	Reservoir Flood Map
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
UU	United Utilities
WFD	Water Framework Directive



EMP-RA3.1: Wirral Waters – Morpeth Wharf, Twelve Quays			
Location	Morpeth Wharf, Birkenhead		
Site area (ha)	1.58		
Watercourse	Mersey Estuary		
EA Model used	Mersey Estuary 2018		
Existing use	Brownfield		
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable		
Proposed use	Employment		
Proposed development flood risk vulnerability classification (NPPF)	Less vulnerable		
Proposed development impermeable area (ha)	1.34		



Figure 1: Existing fluvial / tidal flood zones and flood risk data

The site is located on the Mersey Estuary coastline with Morpeth Dock, which is bound by a canal network, directly to the south of the site boundary. According to the Flood Map for Planning, the risk to the site is both fluvial and tidal. The eastern edge of the site is within tidal Flood Zone 3b with more of the site in the north being covered by fluvial Flood Zone 3a. The north of the site is covered by a FWA and a FAA. The Shoreline Management Plan policy covering this section of coastline is Hold the Line.



The elevation across the whole site remains between 7 and 8 mAOD.

EMP-RA3.1: Wirral Waters – Morpeth Wharf, Twelve Quays								
Flood Source: Tidal								
Flood Zones	Flood Zone 3b	Flood Zone 3b +climate change*	Flood Zone 3a	Flood Zone 3a +climate change*	Flood Zone 2			
	15.7%	+82.1%	15.9%	+84.1%	11.4%			
Tidal: maximum depth	Not available	0.6 m	0.1 m	1.1 m	Not available			

Flood Zone 3b figures stated based on defended model; Flood Zone 3a and 2 figures stated based on undefended model

*climate change figures based on the 70th percentile (higher central allowance)








EMP-RA3.1: Wirral Waters – Morpeth Wharf, Twelve Quays





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EMP-RA3.1: Wirral W	aters – Morpeth Wharf, Twelve	Quays	
	However, the SMP policy ald Line.	ong the Mersey Estuary affec	ting the site is Hold the
Flood Warning Area	According to the EA's FWA dataset, the northern section of the site is covered by an FWA for the Irish Sea and Mersey Estuary from the Head of the Wirral to Runcorn affecting areas of Hoylake, Meols, Moreton and Wallasey.		
Natural Flood Management / Working with Natural Process	The site remains outside of any national scale 'potential for WwNP dataset'.		
Observations, mitigation options & site suitability: tidal	 Approximately 15% of the site is located within Flood Zone 3b localised along the east site boundary which is tidal risk. Development should avoid this area and be directed towards the west, or the site boundary should be redrawn to remove this area from the site. An additional 15% of the site is located within Flood Zone 3a in the northern section. This risk is fluvial according to the Flood Map for Planning, the source of this flooding being The Birket. Less vulnerable uses are appropriate in Flood Zone 3 a although development should still be directed towards areas of Flood Zone 1 in the south of the site as per the sequential approach in the NPPF. The site is entirely covered by the Mersey Estuary 0.5% AEP plus climate change to a maximum depth of 1.1 m in the east and Danger for Most and Danger for All hazard ratings. Safe access and egress via Morpeth Wharf would be achievable during the present day 0.5% AEP tidal event. However, in the long-term the road becomes totally inundated during the 0.5% AEP + climate change event and therefore safe access and egress will prove challenging. Land raising may be a viable option to raise ground floors above the 0.5% AEP event + climate change maximum level which is approx. 1.1 m. The EA would also recommend a further 600mm above the flood level. The EA regulate development or works on, over, under or within 8 metres of fluvial main river watercourses and 16 metres for tidal main river watercourses under the Environmental Permitting (England and Wales) Regulations 2016. Therefore, a flood risk activity permit may be required for this site from the EA. 		
Flood source: infrast	ructure failure – reservoirs (res	idual)	
Flood risk: reservoir	There is no risk of flooding t EA's online RFM.	to the site as a result of dam	failure, according to the
Flood source: infrast	ructure failure – canals (residua	l)	
Flood risk: canal	Morpeth Dock, outside the se	outh of the site boundary, is	bound by a canal system.
Flood source: surface	e water		
Surface Water Flo	od Risk to Proposed Develo	opment Site	
Current site: Risk of Flooding from Surface Water map	High Risk (3.3% AEP event)	Medium Risk (1% AEP event)	Low Risk (0.1% AEP event)
	0%	0%	0.02%
Surface water max flood depths	Not applicable	Not applicable	0.3 – 0.6 m
2021s1045 Wirral	Level 2 SFRA - Site EMP-RA3.1 v2.0		11





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EMP-RA3.1: Wirral W	aters – Morpeth	Wharf, Tw	elve Quays			
Climate change	The current of in extent of t The site rema to the north of 0.6 and 0.9 r egress may p	lay 0.1% <i>F</i> he more fr ains free fr of the site n with a ha prove challe	AEP event outlinequent events. om inundation becomes more azard rating of enging in the fu	during the 0.1% inundated to a significant. The	Adication of the AEP event. I maximum dep refore, safe ac	e likely increase Morpeth Wharf th of between ccess and
Observations, mitigation options & site suitability: surface water	 A drainage water floo consultatio 	- A drainage strategy would be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. This will require consultation with the LLFA.				
Surface Water Flo	ood Risk from	Proposed	l Developmen	t		
Runoff rates should aimed for. For the calculated below ba (I/s).	not exceed cur purposes of thi sed on an assu	rent rates s assessme med 85%	and if possible ent, the require impermeable a	, betterment of ed volumes of at rea and limiting	existing rates tenuation have greenfield rur	should be e been hoff rate of Qbar
Qbar: 9.64 I/s (FEH Q30: 16.38 I/s Q100: 20.04 I/s	Statistical)	on rate: (i	/sec)			
Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volum e m ³	Outflow volume m ³	Attenuation required m ³	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	7	788	170	618	25.4	0.041 ha 2.608 %
30yr Rainfall+40%	8.25	952	200	752	30.9	0.050 ha 3.173 %
100yr Rainfall+20%	8.25	1099	200	899 (281 exceedance storage)	36.9	0.060 ha 3.793%
100yr Rainfall+40%	9.5	1315	231	1084 (332 exceedance storage)	44.5	0.072 ha 4.574 %
Climate change	Application of change antici attenuation v	f the centra pated for t olumes for	al (+20%) and the 2080s in th the 1% AEP a	upper end (+40 e table above sh nd 3.33% AEP r	0%) allowance nows the estim rainfall events.	s for potential ated
Surface water: flood risk impacts from development site, mitigation & SuDS	As part of thi land take if a development Attenuation v AEP event wi development managed on	s Level 2 S pond with volumes ar th exceeda worsening site.	FRA we have i an assumed d e presented for ance flows quar flood risk else	ncluded calculat epth of 1.5m wa the critical stor ntified up to the where, surface	ions to provide as included as rm duration for 1% event. To water runoff m	e an estimated part of the the 3.33% prevent just be



EMP-RA3.1: Wirral W	/aters – Morpeth Wharf, Twelve Quays
Recommendation summary	 Based on the evidence presented in the Level 1 SFRA and this Level 2 SFRA: Early discussions should take place with the EA with regards to the modelled tidal flood risk issues on this site. The EA offers early engagement through an advisory service via their website (https://www.gov.uk/guidance/developers-get-environmental-advice-on-your-planning-proposals) or by emailing the local office: SPPlanning.RFH@environment-agency.gov.uk. Assess options for land raising to protect against the climate change flood level. Include flood resilience measures in site design. Any consideration for development must fully investigate the options presented in this Level 2 SFRA including for the provision of safe access and egress routes at all times. Detailed emergency plans should be produced alongside the EA's flood warnings to ensure the safe evacuation of site users in advance of a flood event occurring.
Can the second part of the Exception Test be satisfied?	Site not subject to the Exception Test though development is appropriate according to the NPPF, subject to suitable FRA including for effective mitigation against climate change.
FRA requirements	 Options for land raising should be explored or the inclusion of resilience techniques i.e. raising of electrical points above flood level, use of hardstanding floors rather than carpets. Options dependant on the intended use of the development. The FRA should include a drainage strategy for the proposed new development layout. The FRA should include emergency planning procedures including the flood warning arrangements currently in place with the EA. Any FRA should be carried out in line with the NPPF; FRCC-PPG; Local Plan and LLFA policies; and national and local SuDS policy and guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and the emergency services.
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Wirral Level 2 Strategic Flood Risk Assessment

JBA

Site EMP-SA5.1

Final Report

February 2022

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Revision History

Revision Ref/Date	Amendments	Issued to
V1.0 Draft September 2021	-	John Entwistle
V2.0 Draft December 2021	Council and EA comments addressed	John Entwistle
V3.0 Final February 2022	Council comments addressed	John Entwistle

Prepared by	Hannah Bishop BSc MSc
	Assistant Analyst
Reviewed by	Mike Williamson BSc MSc CGeog FRGS EADA
	Principal Flood Risk Analyst

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Abbreviations

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EA	Environment Agency
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FMfP	Flood Map for Planning
FAA	Flood Alert Area
FRA	Flood Risk Assessment
FWA	Flood Warning Area
HFM	Historic Flood Map
LIDAR	Light Detection and Radar
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
RFM	Reservoir Flood Map
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
UU	United Utilities
WFD	Water Framework Directive



EMP-SA5.1: Peninsula Business Park		
Location	Reeds Lane, Moreton	
Site area (ha)	1.11	
Watercourse	The Birket and coastal	
EA Model used	Wirral Tidal 2015	
Existing use	Brownfield	
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable	
Proposed use	Employment	
Proposed development flood risk vulnerability classification (NPPF)	Less vulnerable	
Proposed development impermeable area (ha)	0.94	



2021s1045 Wirral Level 2 SFRA - Site EMP-SA5.1 v3.0



Figure 2: Flood risk data

The Main River The Birket flows along the northern site boundary and Flood Zone 3b remains in-channel. The Birket is bound on the right bank by an embankment and flood walls where The Birket flows underneath Reeds Lane. The site is fully within Flood Zone 3a however the whole site is protected by defences and is within an ABD for the Wallasey Embankment. The entire site is covered by two FWAs and two FAAs.



The elevation across the whole site fluctuates slightly from between 3.5 m AOD and 6 m AOD. The Birket watercourse to the north flows at approximately 1.5 m AOD.



EMP-SA5.1: Peninsula Business Park					
Flood Source: Tidal					
Flood Zones	Flood Zone 3b	Flood Zone 3b +climate change*	Flood Zone 3a	Flood Zone 3a +climate change*	Flood Zone 2
	0%	+0%	100%	+0%	0%
Tidal: maximum depth	N/A	N/A	1.8 m	2.9 m	Not available
Flood Zone 3b figur undefended model	es stated based or	n defended model	; Flood Zone 3a a	and 2 figures state	ed based on

*Climate change figures based on higher central allowance (70th percentile)

EMP-SA5.1: Peninsula Business Park

Modelled tidal risk including climate change (Wirral Tidal 2015 model) NOTE: modelled outputs for this SFRA are subtly different to original 2015 modelled outputs due to upgraded modelling and GIS software









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EMP-SA5.1: Peninsu	la Business Park
Historic flooding	There are no areas of historic flooding that affect the site according to the EA's Historic Flood Map (HFM) dataset.
Defences	On the right bank of the Birket, which is closest to the site, there is an embankment that spans the length of the north site boundary which has a design standard of 100 and a condition grade of 3 meaning Fair (Table 1.1 Condition Assessment Manual 2012 ¹). There are also two flood walls on the right bank of the Birket where it passes under Reeds Lane which have design standards of 100 and condition grades of 3. It is not known at this stage whether these defences provide protection to the site. The whole site lies within the EA's A BD polygon, protected from tidal flooding by the Wallasey Embankment along the north coast of the Wirral. The Wallasey embankment is a Council owned defence with a design standard of 200 and a condition grade of 2 meaning Good
	The SMP policy is to Hold the Line, therefore the long-term strategy is for the defences to be adequately maintained and upgraded to maintain the status quo. It would be expected therefore that investment in these defences will continue in the long term.
Flood Warning Area	According to the EA's FWA dataset, there are two FWAs in operation that cover the entire site. One for the River Birket at Leasowe with areas at risk including Pasture Lane, Taran Way North, and Ditton Lane with properties at risk off Reed Lane at Reedville Grove, Cornflower Way and Bullrush Drive. The other FWA covers the Irish Sea and Mersey Estuary from the Head of the Wirral to Runcorn affecting areas of Hoylake, Meols, Moreton and Wallasey.
Natural Flood Management / Working with Natural Process	According to the national scale 'potential for WwNP dataset ', there is a small section in the north west corner that may have potential for flood alleviation of slowing the flow through riparian woodland planting.

 $1\ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291126/scho0509bqat-e-e.pdf$

EMP-SA5.1: Peninsula Business Park Tidal modelling: residual risk Breach of Wallasey Embankment modelling outputs (2021) EMP-SA5.2 EMP-SA5.1 Legend Site boundary REEDSLANE - Main Rivers 0.5% AEP +CC Depths 3 Metres 60 30 0 90 Contains Ordnance Survey data © Crown copyright and database right [2021] Figure 9: modelled tidal depth for the 0.5% AEP plus climate change breach scenario of the Wallasey Embankment



EMP-SA5.1: Peninsula Business Park

Observations, mitigation options & site suitability: tidal	 The whole site is within Flood Zone 3a and is at significant risk from climate change. According to the Flood Map for Planning, the risk is tidal but there is also risk to the surrounding area and from The Birket which is a combination of fluvial and tidal risk. Less vulnerable uses are appropriate in Flood Zone 3a according to the NPPF, assuming appropriate resiltence measures are in place. The site is also within a ABD, protected by the Wallasey Embankment from tidal flooding. In mapping ABDs, the EA assumes that flood defences and other operating structures act perfectly and give the same level of protection as when the previous assessment of the area was made. Consultation with the LLFA on the condition and maintenance arrangements of the Wallasey Embankment should be carried out however it would be expected, given the SMP policy of 'hold the line' that investment in the defences will continue in the long term. According to the EA's Spatial Flood Defences dataset, the defences on The Birket are in fair condition and may have defects that could reduce performance of the asset. The EA should be consulted as to the actual condition of these defences and should provide any details on possible refurbishment or replacement. However, at this stage is not known whether these defences provide any protection to the site. The site is not at residual risk from the present day 0.5% AEP breach scenario of the Wallasey Embankment but in the long term from climate change the whole site is impacted to a maximum depth of 1.9 m and a hazard rating of Danger to All. This breach event highlights the significant risk this site and the north Wirral coastline is at from climate to ange. Safe access and egress are not considered to be achievable based on the present-day Wirral Tidal model 0.5% AEP outline due to total inundation of Reeds Lane and depths around 1.6 m. However, the site is within a ABD and several flood warnings are in place to warn users of the develop
	sustainable development is in place, with consideration to the strategic solutions outlined in the Level 2 SFRA Summary Report.



EMP-SA5.1: Peninsula Business Park			
Flood source: infrast	ructure failure – reservoirs (res	idual)	
Flood risk: reservoir	There is no risk of flooding to the site as a result of dam failure, according to the EA's online RFM.		
Flood source: infrastr	ucture failure – canals (residua	l)	
Flood risk: canal	There are no canals in the vicinity of the site.		
Flood source: surface	e water		
Surface Water Flood Risk to Proposed Development Site			
Current site: Risk of Flooding from Surface Water map	High Risk (3.3% AEP event)	Medium Risk (1% AEP event)	Low Risk (0.1% AEP event)
	1.4%	3.5%	8.9%
Surface water max flood depths	0.3 – 0.6 m	0.3 – 0.6 m	0.3 – 0.6 m

EMP-SA5.1: Peninsula Business Park BIRKET AVENUE PO The Birket E EMP-SA5.2 EMP-SA5.1 E EIS. AVENUE Legend Site boundary REED'S LANK Main Rivers 1% AEP event A5.3 Depth (m) JIBB. < 0.15 0.15 - 0.30 0.30 - 0.60 0.60 - 0.90 1 LE GRO 0.90 - 1.20 > 1.20 __Metres 160 120 40 80 0 Contains Ordnance Survey data © Crown copyright and database right [2021] Figure 11: 1% AEP event surface water flood depths (Risk of Flooding from Surface Water map)



R&D OUTPUTS: FLC	OD RISKS TO PEOPLE. PHASE 2 FD2321/TR2. Delta. March 2000.
Surface water flood risk to development site	Surface water risk is minimal. Approximately 3.5% of the site is at risk of surface water flooding in the 1% AEP event to a maximum depth of between 0.3 and 0.6 m and with areas of low and moderate hazard. The risk is localised to a small area in the north of the site boundary. Safe access and egress would be achievable via Reeds Lane to the north west of the site as this section of road remains free from inundation during the 1% AEP.



EMP-SA5.1: Peninsula Business Park							
	event.						
Climate change	The current day 0.1% AEP event outline provides an indication of the likely increase in extent of the more frequent events. The 0.1% AEP event outline covers approximately 9% of the total site area and the extent is localised to the north of the site. The west of Dock Road North becomes more inundated during the 0.1% AEP event with maximum depths between 0.15 and 0.3 m and the hazard being classed as Low with sections of Moderate; safe access and egress should still be achievable via the north of Reeds Lane.						
Observations, mitigation options & site suitability: surface water	 A full drainage strategy would be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. This will require surface water modelling based on proposed layout plans and consultation with the LLFA. 						
Surface Water Flo	ood Risk from	Proposea	l Developmen	t			
Runoff rates should aimed for. For the calculated below ba (I/s).	not exceed cur purposes of this sed on an assu	rent rates s assessme med 85%	and if possible ent, the require impermeable a	, betterment of ed volumes of at rea and limiting	existing rates tenuation have greenfield rur	should be e been noff rate of Qbar	
Qbar: 4.68 l/s (assu Q30: 7.95 l/s Q100: 9.73 l/s	me 5 l/s minim	um discha	rge) (FEH Stat	istical)			
Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volum e m ³	Outflow volume m ³	Attenuation required m ³	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area	
30yr Rainfall+20%	9.75	605	123	482	38.1	0.032 ha 2.895 %	
30yr Rainfall+40%	11.5	729	145	584	46.2	0.039 ha 3.508 %	
100yr Rainfall+20%	10.75	820	135	684 (202 exceedance storage)	54.2	0.046 ha 4.108 %	
100yr Rainfall+40%	12	974	151	823 (239 exceedance storage)	65.1	0.055 ha 4.943 %	
Climate change	Application of the central (+20%) and upper end (+40%) allowances for potential change anticipated for the 2080s in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.						
Surface water: flood risk impacts from development site, mitigation & SuDS	As part of this Level 2 SFRA we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. Attenuation volumes are presented for the critical storm duration for the 3.33% AEP event with exceedance flows quantified up to the 1% event. To prevent development worsening flood risk elsewhere, surface water runoff must be						
2021s1045 Wirral	Level 2 SFRA - Site	e EMP-SA5.1	V3.0			18	





EMP-SA5.1: Peninsula Business Park				
	made in the longer term as a result of climate change.			
Recommendation summary	 Based on the evidence presented in the Level 1 SFRA and this Level 2 SFRA: Early discussions should take place with the EA with regards to the tidal flood risk issues on this site. The EA offers early engagement through an advisory service via their website (https://www.gov.uk/guidance/developers-get-environmental-advice-on-your-planning-proposals) or by emailing the local office: SPPlanning.RFH@environment-agency.gov.uk. This site should not be developed and should be used as multifunctional greenspace. Were development plans to proceed, given the site is wholly within an ABD protecting the site against tidal risk, the EA and/or LLFA should be consulted specifically for details on the flood defences i.e. condition, maintenance arrangements for the lifetime of the development (~70 years for employment). Assess options for land raising to protect against the climate change flood level. Include flood resilience measures in site design. Any consideration for development must fully investigate the options presented in this Level 2 SFRA including for the provision of safe access and egress routes at all times. Detailed emergency plans should be produced alongside the EA's flood warnings to ensure the safe evacuation of site users in advance of a flood event occurring. 			
Can the second part of the Exception Test be satisfied?	Site not subject to the Exception Test though development is appropriate according to the NPPF, subject to suitable FRA including for effective mitigation against climate change.			
FRA requirements	 Land raising options should be assessed, including raised escape routes. Full consideration should be given to the impact development may have on the adjacent sites RES-SA5.3, EMP-SA5.3 and EMP-SA5.2 The FRA should fully assess emergency planning arrangements and should include a full Emergency Plan for the site. Flood resilience measures should be included in the site design at an early stage of planning. Any FRA should be carried out in line with the NPPF; FRCC-PPG; Local Plan and LLFA policies; and national and local SuDS policy and guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and the emergency services. 			
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Wirral Level 2 Strategic Flood Risk Assessment

JBA

Site EMP-SA5.2

Final Report

February 2022

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JBA Project Manager

Mike Williamson JBA Consulting Second Floor Phoenix House Lakeside Drive Centre Park Warrington WA1 1RX

Revision History

Revision Ref/Date	Amendments	Issued to
V1.0 Draft September 2021	-	John Entwistle
V2.0 Draft December 2021	Council and EA comments addressed	John Entwistle
V3.0 Final February 2021	Council comments addressed	John Entwistle

Prepared by	Laura Thompson BSc
	Assistant Analyst
Reviewed by	Mike Williamson BSc MSc CGeog FRGS EADA
	Principal Flood Risk Analyst

Purpose

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Abbreviations

AOD	Above Ordnance Datum
BGS	British Geological Survey
EA	Environment Agency
FRCC-PPG	Flood Risk and Coastal Change Planning Practice Guidance
FMfP	Flood Map for Planning
FAA	Flood Alert Area
FRA	Flood Risk Assessment
FWA	Flood Warning Area
HFM	Historic Flood Map
LIDAR	Light Detection and Radar
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
RFM	Reservoir Flood Map
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
UU	United Utilities
WFD	Water Framework Directive





EMP-SA5.2: Premier Brands, Reeds Lane – North of Access Road

Figure 1: Existing tidal flood zones and flood risk data

The Main River The Birket runs parallel to the northern border of the site, approximately 13m north of the site boundary. Flood Zone 3b is confined to the open channel to the north of the site. The entirety of the site lies within tidal Flood Zone 3a. Three FWA's are in place impacting the whole site. Two FAA's are present across the site. The whole site lies within the EA's 'Areas Benefitting from Defences' polygon, which shows the areas protected against tidal flooding by the Wallasey Embankment.



EMP-SA5.2: Premier Brands, Reeds Lane – North of Access Road

Figure 2: Topography

The elevation does not vary substantially across the site. The topography is generally highest along the northern and southern boundaries, approx. 5 - 6 mAOD, with lower elevations towards the central areas of the site, approx. 4 mAOD.

Flood Source: Tidal					
Flood Zones	Flood Zone 3b	Flood Zone 3b +climate change*	Flood Zone 3a	Flood Zone 3a +climate change*	Flood Zone 2
	0%	0%	100%	+0%	0%
Tidal: maximum depth	N/A	N/A	2.1 m	3 m	N/A
All figures stated ba	used on undefende	d model			















EMP-SA5.2: Premier	Brands, Reeds Lane – North of Access Road
	The SMP policy is to Hold the Line, therefore the long-term strategy is for the defences to be adequately maintained and upgraded to maintain the status quo. It would be expected therefore that investment in these defences will continue in the long term.
Flood Warning Area	According to the EA's FWA dataset, there are two FWA in operation across the entirety of the site for the River Birket and for the Irish Sea and Mersey Estuary. These cover a number properties across Moreton and Leasowe.
Natural Flood Management / Working with Natural Process	According to the national scale 'potential for WwNP dataset', there is the potential for flood alleviation of slowing the flow through riparian woodland planting at the northern boundary of the site, along the banks of The Birket. This encompasses around half of the site. There is also the potential for the implementation of features to attenuate runoff.
	Image: Cent and the second
	Figure 10: Areas identified as potential for riparian woodland and for the implementation of runoff attenuation features (Working with Natural Processes)
Observations, mitigation options & site suitability: tidal	- The whole site is within Flood Zone 3a and is at significant risk from climate change. According to the Flood Map for Planning, the risk is tidal but there is also risk to the surrounding area and from The Birket which is a combination of fluvial and tidal risk. Less vulnerable uses are appropriate in Flood Zone 3a according to the NPPF, assuming appropriate resilience measures are in place.
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EMP-SA5.2: Premier Brands, Reeds Lane – North of Access Road

Figure 12: Surface water flood hazards (Risk of Flooding from Surface Water map)

* Surface water hazard rating based on Table 4.2 Hazard to People as a Function of Velocity and Depth, R&D OUTPUTS: FLOOD RISKS TO PEOPLE: PHASE 2 FD2321/TR2. Defra. March 2006.

Surface water flood risk to development site	There is nominal surface water flood risk to the site.
Climate change	The current day 0.1% AEP event outline provides an indication of the likely increase in extent of the more frequent events. The 0.1% AEP event outline covers approximately 7% of the total site area and the extent is localised to the northern boundary of the site.
Observations, mitigation options & site suitability: surface water	 Risk is nominal and can be dealt with onsite. A drainage strategy would be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. This will require consultation with the LLFA.

EMP-SA5.2: Premier Brands, Reeds Lane – North of Access Road

Surface Water Flood Risk from Proposed Development

Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for. For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 85% impermeable area and limiting greenfield runoff rate of Qbar (I/s).

Proposed development limiting runoff rate: (I/sec)

Qbar: 6.15 I/s (FEH Statistical)

Q30: 10.46 l/s

Q100: 12.8 l/s

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volum e m ³	Outflow volume m ³	Attenuation required m ³	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	10	802	155	647	41.6	0.043 ha 2.954 %
30yr Rainfall+40%	12	969	186	783	50.4	0.052 ha 3.575 %
100yr Rainfall+20%	11.5	1094	178	915 (268 exceedanc e storage)	58.9	0.061 ha 4.178 %
100yr Rainfall+40%	12*	1285	186	1099 (316 exceedanc e storage)	70.7	0.073 ha 5.018 %

*limited to a 12hr critical storm

Climate change	Application of the central (+20%) and upper end (+40%) allowances for potential change anticipated for the 2080s in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.
Surface water: flood risk impacts from development site, mitigation & SuDS	As part of this Level 2 SFRA we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. Attenuation volumes are presented for the critical storm duration for the 3.33% AEP event with exceedance flows quantified up to the 1% event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.
Flood Source: Groun	dwater
Flood risk: groundwater	Based on geological and hydrogeological information, the BGS dataset can be used to identify areas where geological conditions could enable groundwater flooding to occur and where groundwater may come close to the ground surface. The dataset should not be used on its own to make planning decisions at any scale and should not be used to inform planning decisions at the site scale. The susceptibility data cannot be used on its own to indicate risk of groundwater flooding. The dataset shows that the site is not prone to groundwater flooding.

EMF-SA5.2. Fremmer	Blands, Reeds Lane – North of Access Road
Overall Site Assessn	nent
Access and egress	Based on the risk presented, safe access and egress routes would not be achievable due to the total inundation of Reeds Lane according to Flood Zone 3a. The flood warning system in place should ensure site users can evacuate the site ahead of any potential flood event in the short term. However, the modelled impact from climate change is severe and safe escape routes will be difficult to achieve.
Recommendation summary	 Based on the evidence presented in the Level 1 SFRA and this Level 2 SFRA: Early discussions should take place with the EA with regards to the tidal flood risk issues on this site. The EA offers early engagement through an advisory service via their website (https://www.gov.uk/guidance/developers-get-environmental-advice-on-your-planning-proposals) or by emailing the local office: SPPlanning.RFH@environment-agency.gov.uk. This site should not be developed and should be used as multifunctional greenspace. Were development plans to proceed, given the site is wholly within an ABD protecting the site against tidal risk, the EA and/or LLFA should be consulted specifically for details on the flood defences i.e. condition, maintenance arrangements for the lifetime of the development (~70 years for employment). Assess options for land raising to protect against the climate change flood level. Include flood resilience measures in site design. Any consideration for development must fully investigate the options presented in this Level 2 SFRA including for the provision of safe access and egress routes at all times.
	warnings to ensure the safe evacuation of site users in advance of a flood event occurring.
Can the second part of the Exception Test be satisfied?	Site not subject to the Exception Test though development is appropriate according to the NPPF, subject to suitable FRA including for effective mitigation against climate change.
FRA requirements	 Land raising options should be assessed, including raised escape routes. Full consideration should be given to the impact development may have on the adjacent sites RES-SA5.3, EMP-SA5.3 and EMP-SA5.1. The FRA should fully assess emergency planning arrangements and should include a full Emergency Plan for the site. Flood resilience measures should be included in the site design at an early stage of planning. Any FRA should be carried out in line with the NPPF; FRCC-PPG; Local Plan and LLFA policies; and national and local SuDS policy and guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and the emergency services.
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Site EMP-SA5.3

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RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
UU	United Utilities
WFD	Water Framework Directive



EMP-SA5.3, East of Typhoo, Moreton						
Location	Leasowe					
Site area (ha)	1.93					
Watercourse	The Birket and Coastal					
EA Model used	Birket Fender and Arrowe Brook Fluvial Model 2011 / Wirral Tidal Model 2015					
Existing use	Open space/Greenfield					
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable					
Proposed use	Employment					
Proposed development flood risk vulnerability classification (NPPF)	Less vulnerable					
Proposed development impermeable area (ha)	1.64					



Figure 1: Existing tidal flood zones and flood risk data

The site lies within close proximity of The Birket Main River and is wholly within tidal Flood Zone 3a. Flood Zone 3b is confined to the open channel to the north of the site. There is fluvial risk to the south east of the site from The Birket. The whole site lies within the EA's 'Areas Benefitting from Defences' polygon, which shows the areas protected against tidal flooding by the Wallasey Embankment. The full extent of the site lies within a Flood Alert Area and a Flood Warning Area is in place across the southeast corner of the site. The SMP policy along the coast to the north of the site is Hold the Line.



Figure 2: Topography

The elevation does not vary substantially across the site. There is an area of higher elevation towards the southwest corner of the site (6-7 mAOD) and a small raised mound at the north of the site (6.9 mAOD).

Flood Source: Tidal					
Flood Zones	Flood Zone 3b	Flood Zone 3b +climate change*	Flood Zone 3a	Flood Zone 3a +climate change*	Flood Zone 2
	0%	+0%	100%	+0%	0%
Tidal: maximum depth	N/A	N/A	2.1 m	3.2 m	N/A
All figures stated ba	ased on undefende	d model			

*Tidal climate change figures based on higher central allowance (+70% on peak flows)

















EMP-SA5.3, East of Typhoo, Moreton the 0.5% + CC (higher central) event +600 mm freeboard, as recommended by the EA. The updated maximum elevation within the site boundary therefore increased to 11.33 mAOD. Figure 11 shows the entire site to be flood free when compared to the baseline 0.5% AEP +CC extent in Figure 5. As a result of land raising, modelled depths to the west and north of the site have increased by around 40 mm when the elevation of site EMP-SA5.3 has been increased. The maximum depth within neighbouring site EMP-SA5.2 has increased by 20 mm. The maximum depth within site RES-SA5.3 has decreased by 5mm. The modelled depths to the south of the site are lower than the baseline 0.5% AEP +CC event. Hazard ratings in the area towards the north and west of the site have increased. These areas surrounding the site were previously rated as 'Danger for most', however with the land raising applied the hazard ratings are mostly 'Danger for all'. Hazard ratings to the south of the site have improved, with more areas being classed as 'Danger for most'. Hazard ratings to the east of the site remain the same. EMP-SA5.1 EMP-SA5.2 RES-SA5.3 EMP-SA5.3 Legend Site boundary Land raising 0.5% AEP +CC Baseline 0.5% AEP +CC Metres 80 40 120 160 Contains Ordnance Survey data © Crown copyright and database right [2021] Figure 10: modelled tidal extents for the 0.5% AEP plus climate change land raising scenario




EMP-SA5.3, East of Typhoo, Moreton According to the EA's national scale 'potential for WwNP dataset', there is the potential Natural Flood for flood alleviation of slowing the flow through riparian woodland planting at the Management / Working with south-eastern boundary of the site. Natural Process 1 4 1 1 1 * * EMP-SA5.1 EMP-SA5.2 AVENUE RES-SA5.3 EMP-SA5.3 Leasowe ROAD PASTURE AVENUE Legend Site boundary WwNP Riparian Woodland Potentia + 140 210 280 70 Contains Ordnance Survey data © Crown copyright and database right [2021] Figure 13: Areas identified as potential for riparian woodland (Working with Natural Processes) Observations, The whole site is within Flood Zone 3a and is at significant risk from coastal climate change. According to the Flood Map for Planning, the risk is tidal but mitigation there is also risk to the surrounding area and from The Birket which is a options & site combination of fluvial and tidal risk. Less vulnerable uses are appropriate in suitability: tidal Flood Zone 3a according to the NPPF, assuming appropriate resilience measures are in place. The site is also within an ABD, protected by the Wallasey Embankment from tidal flooding. In mapping ABDs, the EA assumes that flood defences and other operating structures act perfectly and give the same level of protection as when the previous assessment of the area was made. Consultation with the LLFA on the condition and maintenance arrangements of the Wallasey Embankment should be carried out however it would be expected, given the SMP policy of 'hold the line' that investment in the defences will continue in the long term. According to the EA's Spatial Flood Defences dataset, the defences on The Birket are in fair condition and may have defects that could reduce performance of the asset. The EA should be consulted as to the actual condition of these defences and should provide any details on possible refurbishment or replacement

JRA

EMP-SA5.3, East of 1	Typhoo, Moreton
	However, at this stage is not known whether these defences provide any protection to the site.
	 The site is not at residual risk from the present day 0.5% AEP breach scenario of the Wallasey Embankment but in the long term from climate change the whole site is impacted to a maximum depth of 2.2 m and hazard ratings across the site of 'danger for most' to 'danger for all'. This breach event highlights the significant risk this site and the north Wirral coastline are at from climate change. Safe access and egress are not considered to be achievable based on the present-day Wirral Tidal model 0.5% AEP outline due to total inundation of Reedville Grove and maximum depths of around 2 m. However, the site is within an ABD and several flood events occurring
	 Ideally this site would not be developed and would remain as open greenspace which could become multifunctional greenspace for flood storage, amenity use and to provide environmental/ecological benefits.
	- The modelled land raising scenario indicates raising the levels of the site to the 0.5% AEP +CC maximum level, plus 600mm freeboard, would protect the site from tidal flooding in the long term. However, raising the site above the required level of 3.75 m would represent a considerable undertaking.
	- The modelled depths to the north and west of the site have increased by around 40mm. Depths to the south and east have been modelled to decrease with the land raising. Depths within site EMP-SA5.2 are modelled to increase with land raising at site EMP-SA5.3. Therefore, if land raising is considered for this site then it should also mean raising EMP-SA5.2, or at least ensuring that displaced floodwater is directed appropriately away from existing and proposed development, possibly towards The Birket.
	 Flood protection measures, such as raised bunds, should be investigated for the western boundary of the site to protect the existing residential development to the west from increased flood depths as a result of land raising.
	 Modelled depths have decreased to the south and east of the site, used for residential development, indicating benefits to raising the land at the site. Although land raising would be a viable option in protecting the site from tidal flooding, access and egress routes would still need to be available during times of flood, therefore raised escape route options should be investigated. Stilted design may also be an option though is likely to be an expensive design solution with access and egress routes also required to be above the design
	 Were development of this site to proceed, given the proximity of this site to the neighbouring RES-SA5.3, EMP-SA5.2 and EMP-SA5.1, it would be prudent to formulate a strategy to develop these sites in tandem and for consultation between each developer to take place to ensure a joined-up approach for sustainable development is in place, with consideration to the strategic solutions outlined in the Level 2 SFRA Summary Report.
Flood source: infrast	tructure failure – reservoirs (residual)
Flood risk: reservoir	There is no risk of flooding to the site as a result of dam failure, according to the EA's online RFM.



EMP-SA5.3, East of Typhoo, Moreton ۲U N EMP-SA5.1 EMP-SA5.2 AVENUE RES-SA5.3 EMP-SA5.3 EDVILL ROSSAL Leasowe ROAD Legend Site boundary 1% AEP event Hazard rating Low hazard Moderate hazard ROA Significant hazard Extreme hazard 6 100 Metres 70 140 210 280 0 Contains Ordnance Survey data © Crown copyright and database right [2021]

Figure 15: 1% AEP event surface water flood hazards (Risk of Flooding from Surface Water map)

* Surface water hazard rating based on Table 4.2 Hazard to People as a Function of Velocity and Depth, R&D OUTPUTS: FLOOD RISKS TO PEOPLE: PHASE 2 FD2321/TR2. Defra. March 2006.

Surface water flood risk to development site	Approximately 5% of the site is at risk of surface water flooding in the 1% AEP event to a maximum depth greater than 0.3-0.6 m and with areas of moderate hazards. The risk is localised to the southeast corner of the site within the vicinity of Reedville Grove. Overall, the area of the site at risk of surface water flooding is low
Climate change	The current day 0.1% AEP event outline provides an indication of the likely increase in extent of the more frequent events. The 0.1% AEP event outline covers approximately 8% of the total site area and the extent is localised to the low-lying area to the south of the site. Reedville Grove becomes partially inundated with max depths ranging between 0.6 and 0.9 m, and



EMP-SA5.3, East of	Typhoo, Moreto	on				
	hazards mod 0.1% AEP su north of the a surface wa	derate to sig urface water site appear ater flood ev	nificant. Acc flood event. to be viable, vent.	ess may not be v Access to the si as these are not	riable from this te via the minor t shown to be ir	road during a roads to the nundated during
Observations, mitigation options & site suitability: surface water	Development should avoid the 1% AEP surface water event outline. This is localised to a depression in the southern part of the site so should be avoidable. A full drainage strategy would be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. This may require surface water modelling based on proposed layout plans and consultation with the LLFA. Runoff volumes should not exceed greenfield rates. Current risk of surface water flooding is minimal however, this may change if the area of permeable ground is decreased to allow for new development.					
Surface Water Flo	ood Risk fron	n Proposed	d Developme	ent		
Runoff rates should aimed for. For the calculated below ba (I/s).	I not exceed co purposes of th ased on an ass ent limiting ru	urrent rates his assessm umed 85%	and if possib ent, the requ impermeable	ble, betterment o ired volumes of a area and limitin	f existing rates attenuation hav g greenfield rur	should be e been noff rate of Qbar
Qbar: 8.14 I/s (FEH Q30: 13.83 I/s Q100: 16.92 I/s	Statistical)		1300)			
Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m ³	Outflow volume m ³	Attenuation required m ³	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	10	1060	205	855	41.6	0.057 ha 2.953 %
30yr Rainfall+40%	12	1282	246	1036	50.3	0.069 ha 3.579 %
100yr Rainfall+20%	11.5	1446	236	1211 (356 exceedance storage)	58.8	0.081 ha 4.183 %
100yr Rainfall+40%	12*	1699	246	1453 (417 exceedance storage)	70.7	0.097 ha 5.019 %
* Limited to a 12hr	critical storm					
Climate change	Application of change antion attenuation	of the centra cipated for t volumes for	al (+20%) ar he 2080s in t the 1% AEP	nd upper end (+4 the table above s and 3.33% AEP	0%) allowance hows the estim rainfall events.	s for potential ated
Surface water: flood risk impacts from development site, mitigation & SuDS	As part of this Level 2 SFRA we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. Attenuation volumes are presented for the critical storm duration for the 3.33% AEP event with exceedance flows quantified up to the 1% event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.					
2021s1045 Wirral	Level 2 SFRA - S	ite EMP-SA5.3	v2.0			18



EMP-SA5.3, East of 1	Гурhoo, Moreton
Recommendation summary	 Based on the evidence presented in the Level 1 SFRA and this Level 2 SFRA: Early discussions should take place with the EA with regards to the tidal flood risk issues on this site. The EA offers early engagement through an advisory service via their website (https://www.gov.uk/guidance/developers-get-environmental-advice-on-your-planning-proposals) or by emailing the local office: SPPlanning.RFH@environment-agency.gov.uk. This site should not be developed and should be used as multifunctional greenspace. However, land raising could be a viable option to protect the site from tidal flooding in the long term and should be explored at the FRA stage. Flood protection measures, such as raised bunds, should be investigated for the western boundary of the site to protect the existing residential development to the west from increased flood depths as a result of land raising. Options to direct additional floodwater towards The Birket should be consulted specifically for details on the flood defences i.e. condition, maintenance arrangements for the lifetime of the development (~70 years for employment). Include flood resilience measures in site design. Any consideration for development must fully investigate the options presented in this Level 2 SFRA including for the provision of safe access and egress routes at all times. Detailed emergency plans should be produced alongside the EA's flood warnings to ensure the safe evacuation of site users in advance of a flood event occurring.
Can the second part of the Exception Test be satisfied?	Site not subject to the Exception Test though development is appropriate according to the NPPF, subject to suitable FRA including for effective mitigation against climate change.
FRA requirements	 Raised escape routes and displaced floodwater diversion options should be investigated. The FRA should investigate land raising options in more detail and confirm whether raised bunds along the western boundary of the site would be viable. Full consideration should be given to the impact development may have on the adjacent sites RES-SA5.3, EMP-SA5.2 and EMP-SA5.1. Planning for flood risk for each site should be carried out in tandem. The FRA should fully assess emergency planning arrangements and should include a full Emergency Plan for the site. Flood resilience measures should be included in the site design at an early stage of planning. Any FRA should be carried out in line with the NPPF; FRCC-PPG; Local Plan and LLFA policies; and national and local SuDS policy and guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and the emergency services.
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Wirral Level 2 Strategic Flood Risk Assessment

Site EMP-SA5.4

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Purpose

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Abbreviations

AOD	Above Ordnance Datum
BGS	British Geological Survey
EA	Environment Agency
FRCC-PPG	Flood Risk and Coastal Change Planning Practice Guidance
FMfP	Flood Map for Planning
FAA	Flood Alert Area
FRA	Flood Risk Assessment
FWA	Flood Warning Area
HFM	Historic Flood Map
LIDAR	Light Detection and Radar
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
RFM	Reservoir Flood Map
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
UU	United Utilities
WFD	Water Framework Directive



EMP-SA5.4: Land at	Tarran Way North, Moreton
Location	Land at Tarran Way North, Moreton
Site area (ha)	0.25
Watercourse	The Birket and coastal
EA Model used	Wirral Tidal model 2015
Existing use	Brownfield
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable
Proposed use	Employment
Proposed development flood risk vulnerability classification (NPPF)	Less vulnerable
Proposed development impermeable area (ha)	0.21





Figure 2: Existing flood risk data

The Main River The Birket flows eastwards to the north of the site and the entirety of the site lies within Flood Zone 3a which the Flood Map for Planning states is tidal risk. The site is also covered entirely by an ABD for the coastal Wallasey Embankment. The whole site is covered by a tidal FWA and two FAAs.



Figure 3: Topography

The elevation does not vary substantially across the site remaining consistent at between 4 and 5 m AOD. There are areas of slightly higher elevation on the right bank of the River Birket at approximately 6 m AOD. The elevation of the area surrounding the site is generally flat and consistent with that of the site



EMP-SA5.4: Land at Tarran Way North, Moreton

Flood Source: Tidal					
Flood Zones	Flood Zone 3b	Flood Zone 3b +climate change*	Flood Zone 3a	Flood Zone 3a +climate change*	Flood Zone 2
	0%	N/A	100%	100%	0%
Tidal: maximum depth	N/A	N/A	1.9 m	2.9 m	N/A

Flood Zone 3b figures stated based on defended model; Flood Zone 3a and 2 figures stated based on undefended model

*Climate change figures based on higher central allowance (70th percentile)







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EMP-SA5.4: Land at	Tarran Way North, Moreton
Defences	On the right bank of The Birket, which is closest to the site, there are two embankments which both have design standards of 100 and condition grades of 3 meaning Fair (Table 1.1 Condition Assessment Manual 2012 ¹). There are also two flood walls on the right bank of The Birket where it passes under the A551 which have design standards of 100 and condition grades of 3. The whole site lies within the EA's A BD polygon, protected by the Wallasey Embankment along the north coast of the Wirral. The Wallasey embankment is a Council owned defence with a design standard of 200 and a condition grade of 2 meaning Good. The SMP policy is to Hold the Line, therefore the long-term strategy is for the defences to be adequately maintained and upgraded to maintain the status quo. It would be expected therefore that investment in these defences will continue in the long term.
Flood Warning Area	According to the EA's FWA dataset, there are two FWAs in operation that cover the entire site. One for the River Birket at Leasowe with areas at risk including Pasture Lane, Taran Way North, and Ditton Lane with properties at risk off Reed Lane at Reedville Grove, Cornflower Way and Bullrush Drive. The other FWA covers the Irish Sea and Mersey Estuary from the Head of the Wirral to Runcorn affecting areas of Hoylake, Meols, Moreton and Wallasey.
Natural Flood Management / Working with Natural Process	According to the national scale 'potential for WwNP dataset', there is a small section outside the north east corner of the site that may have potential for flood alleviation of slowing the flow through riparian woodland planting. This is also the same for the area surrounding The Birket.

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EMP-SA5.4: Land at Tarran Way North, Moreton The whole site is at flood risk from Flood Zone 3a. According to the Flood Map Observations, for Planning, the risk is tidal but there is also risk to the surrounding area and mitigation options & site River Birket which is a combination of fluvial and tidal risk. Less vulnerable uses are appropriate in Flood Zone 3a according to the NPPF, assuming suitability: tidal appropriate resilience measures are in place. The site is also within a ABD, protected by the Wallasey Embankment from tidal flooding. In mapping ABDs, the EA assumes that flood defences and other operating structures act perfectly and give the same level of protection as when the previous assessment of the area was made. Consultation with the LLFA on the condition and maintenance arrangements of the Wallasey Embankment should be carried out however it would be expected, given the SMP policy of 'hold the line' that investment in the defences will continue in the long term. According to the EA's Spatial Flood Defences dataset, the defences on The Birket are in fair condition and may have defects that could reduce performance of the asset. The EA should be consulted as to the actual condition of these defences and should provide any details on possible refurbishment or replacement. However, at this stage is not known whether these defences provide any protection to the site. The present day 0.5% AEP breach scenario for the Wallasey embankment does not impact the site. However, the site is at significant residual risk in the long term from climate change to a maximum depth of 2 m in the north of the site and a Danger for All hazard rating for the majority of the site. This breach event highlights the significant risk this site and the north Wirral coastline is at from climate change. Safe access and egress are not considered to be achievable based on the Wirral Tidal model 0.5% AEP outline due to total inundation of the A551 to the east of the site with depths of approximately 1.5 m and Tarran Way North to the north of the site as the depths are around 2.2 m. However, the site is within a ABD and several flood warnings are in place to warn users of the development of potential flood events occurring. Land raising may be a viable option to raise ground floors above the 0.5% AEP event +climate change maximum level which is approx. 2.9 m. The EA would also recommend a further 600mm above the design flood level. Given the modelled onsite depths are significant, land raising would likely be a costly solution. Stilted design may also be an option though is likely to be an expensive design solution with access and egress routes also required to be above the design flood level. Flood source: infrastructure failure – reservoirs (residual) Flood risk: There is no risk of flooding to the site as a result of dam failure, according to the reservoir EA's online RFM. Flood source: infrastructure failure – canals (residual) Flood risk: canal There are no canals in the vicinity of this site.

EMP-SA5.4: Land at Tarran Way North, Moreton				
Flood source: surface water				
Surface Water Flo	od Risk to Proposed Devel	opment Site		
Current site: Risk of Flooding from Surface Water map	High Risk (3.3% AEP event)	Medium Risk (1% AEP event)	Low Risk (0.1% AEP event)	
	0%	0%	4.3%	
Surface water max flood depths	Not applicable	Not applicable	0.15 – 0.3 m	

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development site	
Climate change	The current day 0.1% AEP event outline provides an indication of the likely increase in extent of the more frequent events.

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EMP-SA5.4: Land at Tarran Way North, Moreton						
	Long term surface water risk also appears minimal and safe access and egress routes should be available from the A551.					
Observations, mitigation options & site suitability: surface water	- A drainage strategy would be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. Consultation with the LLFA required.					
Surface Water Flo	ood Risk from	Proposed	l Developmen	t		
Runoff rates should aimed for. For the calculated below ba (I/s).	I not exceed cu purposes of thi ased on an assu	rrent rates s assessm imed 85%	and if possible ent, the require impermeable a	, betterment of ed volumes of a rea and limiting	existing rates ttenuation hav greenfield rur	should be e been hoff rate of Qbar
Proposed developme Obar: 0.81 I/s (assu Q30: 1.38 I/s (assu Q100: 1.69 I/s (assu	ent limiting run ume 5 l/s minin me 5 l/s minim ume 5 l/s minir	off rate: (l num discha um dischar num discha	/sec) (FEH Sta [.] Irge) ⁻ ge) arge)	tistical)		
Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volum e m ³	Outflow volume m ³	Attenuation required m ³	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	2	93	25	68	5.4	0.005 ha 1.813 %
30yr Rainfall+40%	2.25	112	28	84	6.6	0.006 ha 2.24 %
100yr Rainfall+20%	2.75	139	35	104 (36 exceedance storage)	8.2	0.007 ha 2.773 %
100yr Rainfall+40%	3.25	168	41	127 (43 exceedance storage)	10.1	0.008 ha 3.387 %
Climate change	Application of the central (+20%) and upper end (+40%) allowances for potential change anticipated for the 2080s in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.					
Surface water: flood risk impacts from development site, mitigation & SuDS	As part of this Level 2 SFRA we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. Attenuation volumes are presented for the critical storm duration for the 3.33% AEP event with exceedance flows quantified up to the 1% event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.					





EMP-SA5.4: Land at Tarran Way North, Moreton				
	of site users ahead of any flood event occurring. Alternative plans may have to be made in the longer term as a result of climate change.			
Recommendation summary	 Based on the evidence presented in the Level 1 SFRA and this Level 2 SFRA: Early discussions should take place with the EA with regards to flood risk issues on this site. The EA offers early engagement through an advisory service via their website (https://www.gov.uk/guidance/developers-get-environmental-advice-on-your-planning-proposals) or by emailing the local office: SPPlanning.RFH@environment-agency.gov.uk. Given the site is wholly within an ABD protecting the site against tidal risk, the EA and/or LLFA should be consulted specifically for details on the flood defences i.e. condition, maintenance arrangements for the lifetime of the development. Assess options for land raising to protect against the climate change flood level. Any consideration for development must fully investigate the options presented in this Level 2 SFRA, including for the provision of safe access and egress routes at all times. Detailed emergency plans will be required alongside the EA's flood warnings to ensure the safe evacuation of site users in advance of a flood event occurring. 			
Can the second part of the Exception Test be satisfied?	Site not subject to the Exception Test though development is appropriate according to the NPPF, subject to suitable FRA including for effective mitigation against climate change.			
FRA requirements	 Land raising options should be assessed, including raised escape routes. The FRA should fully assess emergency planning arrangements and should include a full Emergency Plan for the site. Flood resilience measures should be included in the site design at an early stage of planning Any FRA should be carried out in line with the NPPF; FRCC-PPG; Local Plan and LLFA policies; and national and local SuDS policy and guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and the emergency services. 			
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Wirral Level 2 Strategic Flood Risk Assessment

JBA

Site RES-RA2.1

Final Report

February 2022

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Revision History

Revision Ref/Date	Amendments	Issued to
V1.0 Draft September 2021	-	John Entwistle
V2.0 Draft December 2021	Council and EA comments addressed	John Entwistle
V2.0 Final February 2022		John Entwistle

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LIDAR	Light Detection and Radar
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
RFM	Reservoir Flood Map
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
UU	United Utilities
WFD	Water Framework Directive



RES-RA2.1: Scott's Quay		
Location	Scott's Quay, Wallasey, Birkenhead	
Site area (ha)	3.58	
Watercourse	The Birket/East Float	
EA Model used	Mersey Estuary 2018 (includes tidal Birket)	
Existing use	Industrial and brownfield	
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable	
Proposed use	Residential	
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable	
Proposed development impermeable area (ha)	3.04	



Figure 1: Existing tidal and fluvial flood zones, and flood risk data

The Main River The Birket flows eastwards past the southern boundary of the site before exiting into the Mersey Estuary. The south west corner of the site is within fluvial Flood Zone 3a with the majority of the site within Flood Zone 1, according to the Flood Map for Planning. The EA has confirmed that the risk in this area is dominated by tidal risk and fluvial risk is very low. It is likely the Flood Map for Planning will be updated in due course to reflect this. The Flood Zone 2 area is covered by a FWA and a FAA. The Shoreline Management Plan policy in place for this stretch of coastline is 'hold the line'.



Figure 2: Topography

The elevation across the site predominantly remains the same at around 7 mAOD with the exception of a small area in the south of the site where the elevation is higher ranging between 9 and 12 mAOD. This area appears to be a grassed area within the industrial overall site. To the north west of the site there is an area of higher elevation of approximately 13 mAOD on average.

Flood Source: Tidal					
Flood Zones	Flood Zone 3b	Flood Zone 3b +climate change*	Flood Zone 3a	Flood Zone 3a +climate change*	Flood Zone 2
	0%	+39.1%	3.0%	+91.1%	2.4%
Tidal: maximum depth	Not available	0.2 m	N/A	0.8 m	Not available

Flood Zone 3b figures stated based on defended model; Flood Zone 3a and 2 figures stated based on undefended model

*Climate change figures based on 70th percentile (higher central allowance)

Modelled tidal risk including climate change (Mersey Estuary 2018 model) NOTE: modelled outputs for this SFRA are subtly different to original 2018 modelled outputs due to upgraded modelling and GIS software



event

NOTE: the modelling outputs presented at this site are from the Mersey Estuary 2018 coastal model only. Although Flood Zone 3 (Figure 1) on the site is stated as fluvial, the modelled outputs are tidal only, hence the difference in Flood Zone 3a in Figure 1 and the modelled tidal 0.5% AEP event outline shown above in Figure 3. However, the risk to the site in the long term is dominated by tidal flooding, as shown in Figure 4 below. The EA has also confirmed that fluvial risk in this area is very low

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Historic flooding	There are no areas of historic flooding that affect the site according to the EA's Historic Flood Map (HFM) dataset.
Defences	There is no known flood defence infrastructure in the vicinity of the site.
Flood Warning Area	According to the EA's FWA dataset, there is a FWA in operation in the south-west corner of the site for the Irish Sea and Mersey Estuary from the Head of the Wirral to Runcorn with areas at risk including parts of Hoylake, Meols, Moreton and Wallasey.
Natural Flood Management / Working with Natural Process	The site lies outside the national scale 'potential for WwNP dataset'.
Observations, mitigation options & site suitability: tidal	 The proposed use of development would see a change in risk classification from less vulnerable to more vulnerable according to the NPPF. Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the
2021s1045 Wirral	Level 2 SFRA - Site RES-RA2.1 v2.0 10

 Framework's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the litelime of the development (Para 048 Flood Risk and Coastal Change PPG). The site is at significant long term tidal risk from climate change. The whole site is at risk from the 0.5% AEP event plus climate change to a maximum depth of 0.8 m with a Danger for Most hazard rating. The functional hoodplain could be significantly extended across the site in future, as shown by the 4% AEP event plus climate change to the developed for residential use. Ideally, this site would remain to the site values with appropriate resilience measures put in place to be used as a multifunctional greenspace for flood storage, amenity use and to provide environmental/ecological benefits. Safe access and earess routes must be available at all times of flooding. All surrounding access routes are classified as 'danger for most' in the long terms making the provision for except routes challenging. Any access routes would have to be nised above the 0.5% AEP event +climate change maximum level. A FWA is in place however which should provide advanced warning for site users to evacuate abead of a flood event The modelied hand raising scenarie indicates raising the levels of the site to the 0.5% AFP +CC maximum level, plus 600mm treebard, would protect the site from tidal flooding in the long term. The modelied depths to the north of the site to mitigate any adverse impacts as a result of land raising would be available at site in reside the site raising would prove the available at all times of the site root in the resist in the resist in the resisting residential development. Flood defence measures such as raised bunds should be investigated. The modelies to the north of the site to mitigate any adverse impacts as a result of land raising would be available at all times of the site root tidal flooding in the long term. The modelies depths	RES-RA2.1: Scott's Quay	
 The site is at significant long term tidal risk from climate change. The whole site is at risk from the 0.5% AEP event plus climate change to a maximum optih of 0.8 m with a Danger for Most hazard raing. The functional floodplain could be significantly extended across the site in trutre, as shown by the 4% AEP event plus climate change outline in Figure 3. Given the modelled risk from climate change and the difficulties with access and egress routes, it is recommended this site should not be developed for residential use. Ideally, this site would remain for less vulnerable uses with appropriate resilience measures put in place or be used as a multifunctional greenspace for flood storage, amenity use and to provide environmental/coological benefits. Safe access and egress routes must be available at all times of floading. All surrounding access routes are classified as 'danger for most' in the long terms making the provision for excepte routes challenging. Any access routes would have to be raised above the 0.5% AEP event +climate change maximum level. A tWA is in place however which should provide advanced warning for site users to evacuate ahead of a flood event. The modelled land raising scenario indicates raising the levels of the site to the 0.5% AEP + iCC maximum level, pus dofter most' in the north of the reas our onding the site have increased by around 20mm freeboard, would prolect the slie from tidal flooding, access and egress routes would still need to be available at latt. Onterseed depths to the north of the site on titigate any adverse impacts as a result of and raising would be a valable option in protecting the site from tidal flooding, access and egress routes would still need to be available at missing the investigated. Onterseed depths to the north of the site ontitigate any adverse impacts. Silted development may be an option though is likely to be an expensive diverse intusta available at times of flood, even for above		Framework's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development (Para 048 Flood Risk and Coastal Change PPG).
 The functional floodplain could be significantly extended across the site in future, as shown by the 4% ALP event plus climate change and the difficulties with access and egress routes, it is recommended this site should not be developed for residential use. Ideally, this site would remain for less vulnerable uses with appropriate resilience measures put in place or be used as a multifunctional greenspace for flood storage, amenity use and to provide environmental/coological benefits Sate access and egress routes must be available at all times of flooding. All surrounding access routes are classified as 'danger for most' in the long terms making the provision for escape routes challenging. Any access routes would have to be raised above the 0.5% ALP event + elimate change maximum level. A FWA is in place however which should provide advanced warning for site users to evacuate ahead of a flood event. The modelled load raising scenario indicates raising the levels of the site to the 0.5% ALP + 0.0C maximum level, plus 600mm freeboard, would protect the site from tildal flooding in the long term. The modelled depths to the north of the site have increased by around 20mm. Depths to the rest of the area surrounding the site bave decreased. Increased depths to the north of the site to mitigate any adverse inpacts as a result of land raising within the site boundary. The FRA would be required to contirm the trastistify of this. Although land raising would be a valable option in protecting the site from tidal flooding, access and egress routes would still need to be available during times of flood, therefore raised escape route options should be investigated. Stilted development may be an option though slikely to be an expensive design solution with access and egress routes frave access and egress routes dusing the elapticate as a resul	-	The site is at significant long term tidal risk from climate change. The whole site is at risk from the 0.5% AEP event plus climate change to a maximum depth of 0.8 m with a Danger for Most hazard rating.
 Given the modelled risk from climate change and the difficulties with access and egress routes, It is recommended this site should not be developed for residential use. Ideally, this site would remain for less vulnerable uses with appropriate resilience measures put in place or be used as a multifunctional greenspace for flood storage, amenity use and to provide environmental/ecological benetits Safe access and egress routes must be available at all times of flooding. All surrounding access routes are classified as 'danger for most' in the long terms making the provision for escape routes challenging. Any access routes would have to be raised above the 0.5% AFP event - climate change maximum level. A FWA is in place however which should provide advanced warning for site users to evacuate ahead of a flood event. The modelled land raising scenario indicates raising the levels of the site to the 0.5% AFP + CC maximum level, plus 600mm freeboard, would protect the site from tidal flooding in the long term. The modelled daths to the north of the site nave negatively impact existing residential development. Flood deforce measures used as a result of land raising within the site boundary. The FRA would be required to confirm the feasibility of this. Although land raising would be a viable option in protecting the site from tidal flooding, access and egress routes would sill need to be available during times of flood, therefore raised escape route options should be investigated. Stillted development may be an option though. Is likely to be an expensive design flood level. A further option may be for ground floor parking or other less vulnerable uses (i.e. non residential such as shops, restaurants, offices) and for habitable dwellings to be situated on first floor and upwards. However, safe access and egress routes must be available at times of flood, even for above eqround floor accommodards. The development may be required it the developmen	-	The functional floodplain could be significantly extended across the site in future, as shown by the 4% AEP event plus climate change outline in Figure 3.
 Safe access and egress routes must be available at all times of flooding. All surrounding access routes are classified as 'danger for most' in the long terms making the provision for escape routes challenging. Any access routes would have to be raised above the 0.5% AEP event +climate change maximum level. A FWA is in place however which should provide advanced warning for site users to evacuate ahead of a flood event. The modelled land raising scenario indicates raising the levels of the site to the 0.5% AEP +CC maximum level, plus 600mm freeboard, would protect the site from tidal flooding in the long term. The modelled depths to the north of the site have increased by around 20mm. Depths to the rest of the area surrounding the site have decreased. Increased depths to the north of the site may negatively impact existing residential development. Flood defence measures such as raised bunds should be investigated to the north of the site to mitigate any adverse impacts as a result of land raising would be a viable option in protecting the site from tidal flooding, access and egress routes also required to be available during times of flood, therefore raised escape route options should be investigated. Stilted development may be an option though is likely to be an expensive design flood level. A further option may be for ground floor parking or other less vulnerable uses (i.e. non-residential such as shops, restaurants, offices) and for habitable dwellings to be situated on first floor and upwards. However, safe access and egress routes must be available at the exist or and not be exacerbated. A flood firsk activity permit may be required if the development of the site is within 16 metres of the tidally influenced Birket Main River. Details on obtaining a Flood Risk Activity Permit are available from the EA. Also, the EA advises against development within Bm of any watercourse to enable access for maintenance works. Were development of this site to pr	-	Given the modelled risk from climate change and the difficulties with access and egress routes, it is recommended this site should not be developed for residential use. Ideally, this site would remain for less vulnerable uses with appropriate resilience measures put in place or be used as a multifunctional greenspace for flood storage, amenity use and to provide environmental/ecological benefits
 The modelled land raising scenario indicates raising the levels of the site to the 0.5% AEP +CC maximum level, plus 600mm freeboard, would protect the site from tidal flooding in the long term. The modelled depths to the north of the site have increased by around 20mm. Depths to the rest of the area surrounding the site have decreased. Increased depths to the north of the site may negatively impact existing residential development. Flood defence measures such as raised bunds should be investigated to the north of the site to mitigate any adverse impacts as a result of land raising within the site boundary. The FRA would be required to confirm the feasibility of this. Although land raising would be a viable option in protecting the site from tidal flooding, access and egress routes would still need to be available during times of flood, therefore raised escape route options should be investigated. Stilted development may be an option though is likely to be an expensive design solution with access and egress routes also required to be above the design flood level. A further option may be for ground floor parking or other less vulnerable uses (i.e. non-residential such as shops, restaurants, offices) and for habitable dwellings to be situated on first floor and upwards. However, safe access and egress routes must be available at times of flood, even for above ground floor accommodation. The SMP policy along the stretch of coast affecting the site is to Hold the Line, therefore the long-term strategy is for the current modelled flood risk to remain and not be exacerbated. A flood risk activity permit may be required if the development of the site is on obtaining a Flood Risk Activity Permit are available from the EA. Also, the EA advises against development within 8m of any watercourse to enable access for maintenance works. Were development of this site to proceed, given the proximity of this site to the neighbouring RES-RA6.5, it would be pru	_	Safe access and egress routes must be available at all times of flooding. All surrounding access routes are classified as 'danger for most' in the long terms making the provision for escape routes challenging. Any access routes would have to be raised above the 0.5% AEP event +climate change maximum level. A FWA is in place however which should provide advanced warning for site users to evacuate ahead of a flood event.
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2021s1045 Wirral Level 2 SFRA - Site RES-RA2.1 v2.0 11	-	Were development of this site to proceed, given the proximity of this site to the neighbouring RES-RA6.5, it would be prudent to formulate a strategy to develop these sites in tandem and for consultation between each developer to
	2021s1045 Wirral Level 2 S	SFRA - Site RES-RA2.1 v2.0 11

RES-RA2.1: Scott's C	Quay		
	take place to ensure place, with considerat Summary Report.	a joined-up approach for s ion to the strategic solutions	ustainable development is in s outlined in the Level 2 SFRA
Flood source: infrast	ructure failure – reservoirs (resi	dual)	
Flood risk: reservoir	There is no risk of flooding to the site as a result of dam failure, according to the EA's online RFM.		
Flood source: infrast	ructure failure – canals (residual)	
Flood risk: canal	There are no canals in the vicinity of the site.		
Flood source: surface	e water		
Surface Water Flo	od Risk to Proposed Develo	opment Site	
Current site: Risk of Flooding from	High Risk (3.3% AEP event)	Medium Risk (1% AEP event)	Low Risk (0.1% AEP event)
map	0.4%	2.2%	10.7%
Surface water max flood depths	0.15 – 0.3 m	0.3 – 0.6 m	0.3 – 0.6 m





Figure 11: 1% AEP event surface water flood hazards (Risk of Flooding from Surface Water map)

* Surface water hazard rating based on Table 4.2 Hazard to People as a Function of Velocity and Depth, R&D OUTPUTS: FLOOD RISKS TO PEOPLE: PHASE 2 FD2321/TR2. Defra. March 2006.

Surface water flood risk to development site	There is nominal risk to the site from surface water. Safe access and egress would be achievable via the south west of the site
Climate change	The current day 0.1% AEP event outline provides an indication of the likely increase in extent of the more frequent events. The 0.1% AEP event outline covers approximately 11% of the total site area and the extent is constrained by the existing building in the centre of the site and along





Surface Water Flood Risk from Proposed Development

Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for. For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 85% impermeable area and limiting greenfield runoff rate of Qbar (I/s).

Proposed development limiting runoff rate: (I/sec)

Obar: 21.49 I/s (FEH Statistical)

Q30: 36.54 l/s

Q100: 44.70 l/s

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volum e m ³	Outflow volume m ³	Attenuation required m ³	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	7	1785	379	1406	25.9	0.094 ha 2.618 %
30yr Rainfall+40%	8.5	2171	460	1710	31.5	0.114 ha 3.184 %
100yr Rainfall+20%	8.25	2487	447	2040 (634 exceedance storage)	37.6	0.136 ha 3.799 %
100yr Rainfall+40%	9.5	2976	514	2462 (752 exceedance storage)	45.3	0.164 ha 4.585 %
Climate change	Application o change antic attenuation v	f the centraipated for the following the following the following the following the following following the followi	al (+20%) and the 2080s in the r the 1% AEP a	upper end (+40 e table above sh nd 3.33% AEP r	0%) allowance nows the estim rainfall events.	s for potential ated
Surface water: flood risk impacts from development site, mitigation & SuDS	As part of thi land take if a development Attenuation AEP event wi development managed on	s Level 2 S pond with /olumes ar th exceeda worsening site.	SFRA we have in an assumed do e presented for ance flows quar g flood risk else	ncluded calculat epth of 1.5m wa the critical stor tified up to the where, surface	ions to provide as included as m duration for 1% event. To water runoff m	e an estimated part of the the 3.33% prevent just be



Flood Source: Groundwater



RES-RA2.1: Scott's C	Quay
Recommendation summary	 Based on the evidence presented in the Level 1 SFRA and this Level 2 SFRA: Early discussions should take place with the EA with regards to the tidal flood risk issues on this site. The EA offers early engagement through an advisory service via their website (https://www.gov.uk/guidance/developers-get-environmental-advice-on-your-planning-proposals) or by emailing the local office: SPPlanning.RFH@environment-agency.gov.uk. It is recommended that this site should not be developed for residential use given the significant long-term risk with climate change. The site should remain for less vulnerable uses with resilience measures in place or alternatively left as open space and social and environmental benefits. Land raising may be a viable option to protect the site from tidal flooding in the long term. Flood defence measures such as raised bunds should be considered to the north of the site to avoid any adverse impacts to existing residential development. This should be explored at the FRA stage. Any consideration for development must fully investigate the options presented in this Level 2 SFRA, including for the provision of safe access and egress routes.
Can the second part of the Exception Test be satisfied?	To pass the Exception Test, it must be proven that the site can be safe for its lifetime, which for residential development is 100 years. The climate change modelling in this Level 2 SFRA shows this will not be possible. However, land raising may be a viable option and should be explored further at the FRA stage.
FRA requirements	 For development to proceed, the FRA must show the development can be safe for its lifetime and must not increase risk elsewhere. The FRA should determine whether the implementation of flood defence measures would be feasible to the north of the site. Full consideration should be given to the impact development may have on the adjacent site RES-RA6.5, including any land raising. The FRA should include emergency planning procedures with consideration to ensuring safe access and egress routes in times of flood. Any site-specific work should be carried out in line with the NPPF; FRCC-PPG; Local Plan and LLFA policies; and national and local SuDS policy and guidelines. Consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and the emergency services.

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Wirral Level 2 Strategic Flood Risk Assessment

JBA

Site RES-RA5.1

Final Report

February 2022

www.jbaconsulting.com



JBA Project Manager

Mike Williamson JBA Consulting Second Floor Phoenix House Lakeside Drive Centre Park Warrington WA1 1RX

Revision History

Revision Ref/Date	Amendments	Issued to
V1.0 Draft September 2021	-	John Entwistle
V2.0 Draft December 2021	Council and EA comments addressed	John Entwistle
V2.0 Final February 2022		John Entwistle

Prepared by	Laura Thompson BSc
	Assistant Analyst
Reviewed by	Mike Williamson BSc MSc CGeog FRGS EADA
	Principal Flood Risk Analyst

Purpose

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Abbreviations

AOD	Above Ordnance Datum
BGS	British Geological Survey
EA	Environment Agency
FRCC-PPG	Flood Risk and Coastal Change Planning Practice Guidance
FMfP	Flood Map for Planning
FAA	Flood Alert Area
FRA	Flood Risk Assessment
FWA	Flood Warning Area
HFM	Historic Flood Map
LIDAR	Light Detection and Radar
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
RFM	Reservoir Flood Map
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
UU	United Utilities
WFD	Water Framework Directive



RES-RA5.1: SHLAA 4078 Hind street			
Location	Birkenhead		
Site area (ha)	7.87		
Watercourse	Mersey Estuary		
EA Model used	Mersey Estuary 2018 Model		
Existing use	Brownfield		
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable		
Proposed use	Residential		
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable		
Proposed development impermeable area (ha)	6.69		





Figure 2: Topography

The elevation varies across the site. The topography generally slopes northwards from higher ground to the south at approx. 15 mAOD at the southern site boundary down to around 6 mAOD at the northern site boundary.

Flood Zones	Flood Zone 3b	Flood Zone 3b +climate change*	Flood Zone 3a	Flood Zone 3a +climate change*	Flood Zone 2
	0%	+60%	0%	+71%	0%
Tidal: maximum depth	N/A	1.86 m	N/A	2.99 m	N/A
All figures stated ba *Climate change fig	used on undefende Jures based on 70	ed model th percentile (higł	ner central allowa	nce)	

RES-RA5.1: SHLAA 4078 Hind street

Modelled tidal risk including climate change (Mersey Estuary 2018 model) NOTE: modelled outputs for this SFRA are subtly different to original 2018 modelled outputs due to upgraded modelling and GIS software



Figure 3: modelled tidal flood outlines for 0.5% AEP plus higher central climate change allowance

Note: Modelled baseline flood extents for the 0.5% AEP event vary from the existing Flood Zone 3a outlines. This is a result of the existing flood zones using the old Coastal Flood Boundaries (CFB) from 2011 and the model having a base year of 2015. The previous CFB excluded data from the Class A gauge at Liverpool due to differences with the surrounding gauges at Heysham and Hilbre Island. The new CFB in 2018 included gauge data from Liverpool and an uplift was added to get the model to a base year of 2021, meaning the levels at the mouth of the estuary increased by over 0.3m causing additional flooding to certain areas.

The current Flood Map for Planning therefore will underestimate present day tidal flood risk to the Wirral hence why the Flood Map for Planning (Figure 1) shows the site to be in Flood Zone 1. The tidal models should be updated with the new CFB data. As more recent **data is available which hasn't been built into the flood zones, a** precautionary approach should be adopted pending the updating of the tidal models and subsequent updates to the Flood Map for Planning. The tidal models should be updated with the new CFB data.





JRA







Figure 7: 1% AEP event surface water flood hazards (Risk of Flooding from Surface Water map)

*Surface water hazard rating based on Table 4.2 Hazard to People as a Function of Velocity and Depth, R&D OUTPUTS: FLOOD RISKS TO PEOPLE: PHASE 2 FD2321/TR2. Defra. March 2006.

Surface water flood risk to development site	Approximately 25% of the site is at risk of surface water flooding in the 1% AEP event to a maximum depth of between 0.6 and 0.9 m and with areas of low, moderate and significant hazard. The risk in all events is primarily localised to the central area of the site, with some areas of surface water flood risk scattered around the southern boundary of the site. The land here is low-lying, hard standing industrial brownfield land.
Climate change	The present day 0.1% AEP event outline provides an indication of the likely increase in extent of the more frequent events. The 0.1% AEP event outline covers almost 65% of the total site area and the extent is primarily across the northern and central areas of the site, but with some





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RES-RA5.1: SHLAA	1078 Hind street	:						
	 in addition to those managing development runoff. Full consultation with the LLFA will be important at this site. Assessment of any current drainage system in place should be carried out to ascertain any current capacity issues and whether the current system could accommodate proposed residential development or whether further capacity will be required. 							
Surface Water Flo	od Risk from	Proposed	d Developmen	t				
Runoff rates should aimed for. For the calculated below ba (I/s).	not exceed cu purposes of thi sed on an assu	rrent rates is assessm ımed 85%	and if possible ent, the require impermeable a	, betterment of ed volumes of a rea and limiting	existing rates ttenuation hav g greenfield rur	should be e been noff rate of Qbar		
Proposed developme Qbar: 41.57 l/s (FEF Q30: 70.66 l/s Q100: 86.46 l/s	ent limiting run HStatistical)	off rate: (I	/sec)					
Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volum e m ³	Outflow volume m ³	Attenuation required m ³	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area		
30yr Rainfall+20%	8.25	4101	864	3237	30.8	0.216 ha 2.742 %		
30yr Rainfall+40%	9.75	4953	1021	3932	37.4	0.262 ha 3.331 %		
100yr Rainfall+20%	9.75	5692	1021	4670 (1433 exceedanc e storage)	44.5	0.311 ha 3.956 %		
100yr Rainfall+40%	11	6782	1152	5629 (1697 exceedanc e storage)	53.6	0.375 ha 4.768 %		
Climate change	Application of the central (+20%) and upper end (+40%) allowances for potential change anticipated for the 2080s in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.							
Surface water: flood risk impacts from development site, mitigation & SuDS	As part of this Level 2 SFRA we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. Attenuation volumes are presented for the critical storm duration for the 3.33% AEP event with exceedance flows quantified up to the 1% event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.							


RES-RA5.1: SHLAA 4078 Hind street



RES-RA5.1: SHLAA 4078 Hind street				
Recommendation summary	 Based on the evidence presented in the Level 1 SFRA and this Level 2 SFRA: Early discussions should take place with the EA with regards to the tidal flood risk issues on this site. The EA offers early engagement through an advisory service via their website (https://www.gov.uk/guidance/developers-get-environmental-advice-on-your-planning-proposals) or by emailing the local office: SPPlanning.RFH@environment-agency.gov.uk. Development should be directed to the areas outside of the climate change risk area. Based on current ground conditions, there should be no development in the low-lying area within the centre of the site. Expected development yields may have to be revised. Based on the 0.5% AEP event +climate change, this site should not be developed for residential use. Ideally, this site would remain for less vulnerable uses with appropriate resilience measures put in place. Early consultation with the LLFA should be carried out regarding surface water flood risk control and mitigation onsite. Detailed surface water modelling should be carried out post site clearance and pre-development to ascertain natural flow paths and depressions. Regrading of the land and redirecting of surface water should be assessed with layout plans including for SuDS and storage of surface water onsite. Investigation into appropriate SuDS options should be explored to reduce the risk of surface water flooding from the site. 			
Can the second part of the Exception Test be satisfied?	Site not subject to the Exception Test though development may be permitted assuming it can be shown that surface water and long term tidal flood risk can be mitigated effectively onsite and included within the site design. If not, development of this site should not be permitted.			
FRA requirements	 Further modelling of surface water risk pre and post development options should be carried out with full consultation with the LLFA. Options for land raising could be assessed and modelled for any development planned in Flood Zone 3a +climate change. The FRA should include a detailed drainage strategy for the proposed new development layout. Emergency Plan should accompany the FRA detailing safe access and egress routes in times of flood. Any FRA should be carried out in line with the NPPF; FRCC-PPG; Local Plan and LLFA policies; and national and local SuDS policy and guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and the emergency services. 			
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Wirral Level 2 Strategic Flood Risk Assessment

JBA

Site RES-RA6.1

Final Report

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Prepared by	Maria Botterill BSc
	Analyst
Reviewed by	Mike Williamson BSc MSc CGeog FRGS EADA
	Principal Flood Risk Analyst

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LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
RFM	Reservoir Flood Map
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
UU	United Utilities
WFD	Water Framework Directive



RES-RA6.1: Wirral W	/aters – Sky City
Location	Wirral Waters
Site area (ha)	5.07
Watercourse	The Birket/West Float
EA Model used	Mersey Estuary 2018 Model
Existing use	Commercial
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable
Proposed use	Mixed use
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable
Proposed development impermeable area (ha)	4.31



Figure 1: Existing fluvial and tidal flood zones, and flood risk data

The site is a docking strip within the East Float of the port adjacent to the Mersey Estuary and Vittoria Dock. The Birket flows eastwards in the Mersey Estuary to the north of the site. The site is almost completely surrounded by water and sits within Flood Zone 1, with the exception of a narrow strip along the southern boundary, which is within fluvial Flood Zone 3a, according to the Flood Map for Planning. The EA has confirmed that the risk in this area is dominated by tidal risk and fluvial risk is very low. It is likely the Flood Map for Planning will be updated in due course to reflect this. A small portion of the site also lies within Flood Zone 3b (2.5%), however this is confined to the boundaries of the site along the tidal waterbody. The site lies within a FWA and a FAA area is in place along the southern boundary, coinciding with the location of Flood Zone 3a. Safe access and egress routes appear limited. There is no historic flooding mapped within the vicinity of the site.



Figure 2: Topography

The site is situated at approximately 7m AOD which does not vary.

Flood Source: Tidal					
Flood Zones	Flood Zone 3b	Flood Zone 3b +climate change*	Flood Zone 3a	Flood Zone 3a +climate change*	Flood Zone 2
	2.5%	+1.4%	12.1%	+87.9	0.2%
Tidal: maximum depth	N/A	0.9 m	0.64 m	1.8 m	N/A
All figures stated based on undefended model					

*Climate change figures based on 70th percentile (higher central allowance)

RES-RA6.1: Wirral Waters – Sky City Modelled tidal risk including climate change (Mersey Estuary 2018 model) NOTE: modelled outputs for this SFRA are subtly different to original 2018 modelled outputs due to upgraded modelling and GIS software RES-RA6.1 /ittona Dock Legend Site boundary 0.5% AEP depths 3.27 ES-RA6.2 0.002 Metres 100 150 50 Contains Ordnance Survey data Crown copyright and database right [2021] Figure 3: modelled tidal flood depths (m) for 0.5% AEP baseline event NOTE: the modelling outputs presented at this site are from the Mersey Estuary 2018 coastal model only. Although Flood Zone 3 (Figure 1) on the site is stated as fluvial, the modelled outputs are tidal only, hence the difference in Flood Zone 3a in Figure 1 and the modelled tidal 0.5% AEP event outline shown above in Figure 3. However, the risk to the site in the long term is dominated by tidal flooding. The

EA has also confirmed that fluvial risk in this area is very low













RES-RA6.1: Wirral Waters – Sky City

should be considered with land raising at the adjacent site RES-RA6.2.

The elevation of the site was uplifted by 3.89 m to reflect the maximum levels for the 0.5% + CC (higher central) event +600 mm freeboard, as recommended by the EA. The updated maximum elevation within the site boundary therefore increased to 11 mAOD. Figure 8 shows the entire site to be flood free when compared to the baseline 0.5% AEP +CC extent in Figure 3.

Site RES-RA6.2 has also been considered and remodelled to assess land raising so there has been no additional impact to this site.







RES-RA6.1: Wirral Wa	aters – Sky City
	 the lifetime of the development (Para 048 Flood Risk and Coastal Change PPG). Just over 12% of the site is located within fluvial Flood Zone 3a which covers the southern boundary of the site. However, the EA has confirmed that the risk in this area is dominated by tidal risk and fluvial risk is very low. It is likely the Flood Map for Planning will be updated in due course to reflect this. The southern site boundary should be pulled back out of Flood Zone 3a or this area should not be developed. The Mersey Estuary 0.5% AEP event +CC outputs indicate the entire site is at risk of tidal flooding in the future, with depths across the site ranging between 0.3 m to 1.8 m. Safe access and egress routes must be available at times of flooding. This will prove challenging as the only access road. Duke Street, partly lies within Flood Zone 3a and it entirely at risk from climate change. Any access routes would have to be raised above the 0.5% AEP event +climate change maximum level. Options for raised pedestrian footbridges over the East Float and Vittoria docks to areas outside the 0.5% AEP event +climate change extent should be explored. A FWA is in place however which should provide advanced warning for site users to evacuate ahead of a flood event. Given the modelled risk from climate change and the difficulties with access and egress routes, it is recommended this site should not be developed for residential use. Ideally, this site would represent a considerable undertaking. The modelled land raising scenario indicates raising the levels of the site to the 0.5% AEP +CC maximum level, plus 600mm freeboard, would protect the site from tidal flooding in the long term. However, raising the site above the required level of 3.89 m would represent a considerable undertaking. Land raising at site RES-RA6.2 should be implemented with consideration of land raising at the site. Although land raising would be a viable option in protecting the site
Flood source: infrast	ructure failure – reservoirs (residual)
Flood risk: reservoir	There is no risk of flooding to the site as a result of dam failure, according to the EA's online RFM.
Flood source: infrastr	ructure failure – canals (residual)
Flood risk: canal	There are no canals in the vicinity of this site.



RES-RA6.1: Wirral W	′aters – Sky Cit	y					
Flood source: surface	e water						
Surface Water Flo	od Risk to Pr	roposed De	evelopment S	ite			
Current site: Risk of Flooding from	High Risk (3.3% AEP event)		Me (1%	Medium Risk (1% AEP event)		Low Risk (0.1% AEP event)	
Surface Water map	0.0	04%		0.3%		0.3%	
Surface water max flood depths	0.6 -	- 0.9m	0	.3 - 0.6m	O.	6 – 0.9m	
Surface water flood risk to development site	Nominal sur	face water	risk to the site.				
Climate change	Nominal risk						
Observations, mitigation options & site suitability: surface water	 Assessment of the current drainage system in place should be carried out to ascertain any current capacity issues and whether the current system could accommodate proposed residential development or whether further capacity will be required. A drainage strategy would be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. This will require consultation with the LLFA. 						
Surface Water Flo	ood Risk fron	n Proposed	d Developmen	t			
Admontrates should aimed for. For the calculated below ba (I/s). Proposed developme Qbar: 29.68 I/s (FEF Q30: 50.45 I/s Q100: 61.73 I/s	ent limiting ru	noff rate: (I	/sec)	ed volumes of a	ttenuation hav	e been hoff rate of Qbar	
Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volum e m ³	Outflow volume m³	Attenuation required m ³	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area	
30yr Rainfall+20%	7.25	2565	542	2023	27	0.135 ha 2.660 %	
30yr Rainfall+40%	8.75	3114	654	2459	32.8	0.164 ha 3.233 %	
100yr Rainfall+20%	8.5	3562	636	2926 (903 exceedanc e storage)	39	0.195 ha 3.847 %	
100yr Rainfall+40%	10.25	4295	767	3529 (1070 exceedanc e storage)	47	0.235 ha 4.640 %	
Climate change	Application of the central (+20%) and upper end (+40%) allowances for potential change anticipated for the 2080s in the table above shows the estimated						

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RES-RA6.1: Wirral Waters – Sky City

	attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.
Surface water: flood risk impacts from development site, mitigation & SuDS	 As part of this Level 2 SFRA we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. Attenuation volumes are presented for the critical storm duration for the 3.33% AEP event with exceedance flows quantified up to the 1% event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site. Surface water runoff should be fully attenuated to a pre-agreed runoff rate. SuDS may be possible however, this would be subject to ground investigation and contaminated land assessment at the FRA stage. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.

Flood Source: Groundwater

Flood risk: groundwater



Figure 11: Susceptibility of groundwater flooding (BGS national dataset)

Based on geological and hydrogeological information, the BGS dataset can be used to identify areas where geological conditions could enable groundwater flooding to occur and where groundwater may come close to the ground surface. The dataset should not be used on its own to make planning decisions at any scale and should not be used to inform planning decisions at the site scale. The susceptibility data cannot be used on its own to indicate risk of groundwater flooding. The dataset shows that the site is not prone to groundwater flooding.



RES-RA6.1: Wirral Waters – Sky City		
Overall Site Assessm	nent	
Access and egress	Safe access and egress routes may prove challenging as the only access road, Duke Street, lies within Flood Zone 3a. However, the location of the site within a Flood Warning Area should ensure users are evacuated safely in advance of a flood event. Raised walkways may be required and footbridges over the docks should be investigated.	
Recommendation summary	 Based on the evidence presented in the Level 1 SFRA and this Level 2 SFRA: Early discussions should take place with the EA with regards to tidal flood risk issues on this site. The EA offers early engagement through an advisory service via their website (https://www.gov.uk/guidance/developers-get-environmental-advice-on-your-planning-proposals) or by emailing the local office: SPPlanning.RFH@environment-agency.gov.uk. It is recommended that this site should not be developed for residential use given the significant long-term risk with climate change. The site should remain for less vulnerable uses with resilience measures in place. Modelled land raising scenarios indicate that this could be an option to protect the site from long term tidal flooding. This should be explored at the FRA stage. No development within 8 m of The Birket/West Float. 	
Can the second part of the Exception Test be satisfied?	To pass the Exception Test, it must be proven that the site can be safe for its lifetime, which for residential development is 100 years. The climate change modelling in this Level 2 SFRA shows this will not be possible. However, land raising may be a viable option and should be explored further at the FRA stage.	
FRA requirements	 The FRA should assess the options for raised pedestrian routes to ensure safe access and egress to the site. Full consideration should be given to the impact development may have on the adjacent site RES-RA6.2. The FRA should include emergency planning procedures with consideration to ensuring safe access and egress routes in times of flood. Any FRA should be carried out in line with the NPPF; FRCC-PPG; Local Plan and LLFA policies; and national and local SuDS policy and guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and the emergency services. 	
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Wirral Level 2 Strategic Flood Risk Assessment

JBA

Site RES-RA6.2

Final Report

February 2022

www.jbaconsulting.com



JBA Project Manager

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Revision History

Revision Ref/Date	Amendments	Issued to
V1.0 Draft September 2021	-	John Entwistle
V2.0 Draft December 2021	Council and EA comments addressed	John Entwistle
V2.0 Final February 2022		John Entwistle

Prepared by	Hannah Bishop BSc MSc
	Assistant Analyst
Reviewed by	Mike Williamson BSc MSc CGeog FRGS EADA
	Principal Flood Risk Analyst

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Abbreviations

AOD	Above Ordnance Datum
BGS	British Geological Survey
EA	Environment Agency
FRCC-PPG	Flood Risk and Coastal Change Planning Practice Guidance
FMfP	Flood Map for Planning
FAA	Flood Alert Area
FRA	Flood Risk Assessment
FWA	Flood Warning Area
HFM	Historic Flood Map
LIDAR	Light Detection and Radar
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
RFM	Reservoir Flood Map
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
UU	United Utilities
WFD	Water Framework Directive



RES-RA6.2: Wirral Waters – Vittoria Studios		



Figure 1: Existing fluvial and tidal flood zones, and flood risk data

The Main River The Birket flows eastwards into the Mersey Estuary to the north of the site with the site being located on Vittoria Dock. 33% of the site is within fluvial Flood Zone 3a, according to the Flood Map for Planning. The EA has confirmed that the risk in this area is dominated by tidal risk and fluvial risk is very low. It is likely the Flood Map for Planning will be updated in due course to reflect this. There is a FWA and a FAA covering the west section and a portion of the east of the site.



Figure 2: Topography

The elevation across the whole site does not vary substantially ranging between 6.5 and 7 mAOD. The area of water at Vittoria Dock has a lower elevation of approximately 5 mAOD and there is an area of higher elevation to the south west of the site of around 12 mAOD which gradually declines towards the site.

Flood Source: Tidal					
Flood Zones	Flood Zone 3b	Flood Zone 3b +climate change*	Flood Zone 3a	Flood Zone 3a +climate change*	Flood Zone 2
	1.6%	+2.0%	33.4%	+66.6%	9.1%
Tidal: maximum depth	Not available	0.1 m	N/A (within waterbody)	0.9 m	Not available

RES-RA6.2: Wirral Waters – Vittoria Studios

Flood Zone 3b figures stated based on defended model; Flood Zone 3a and 2 figures stated based on undefended model

*Climate change figures based on 70th percentile (higher central allowance)

Modelled tidal risk including climate change (Mersey Estuary 2018 model) NOTE: modelled outputs for this SFRA are subtly different to original 2018 modelled outputs due to upgraded modelling and GIS software













RES-RA6.2: Wirral Waters – Vittoria Studios

Estuary 2018 model)

FRA for the site should assess this further once site layout options are established. It should be noted that modelled outputs represent land raising at both this site and site RES-RA6.2. Therefore, any decisions made to raise the land at this site

The elevation of the site was uplifted by 3.73 m to reflect the maximum levels for the 0.5% + CC (higher central) event +600 mm freeboard, as recommended by the EA. The updated maximum elevation within the site boundary therefore increased to 11.29 mAOD. Figure 8 shows the entire site to be flood free when compared to

places. This is likely due to a combination of increased floodwater storage within the docks between the two sites, and the raised land acting as an embankment to

industrial development. Site RES-RA6.1 has also been considered and remodelled to assess land raising and there has been no additional impact to this site. Hazard ratings to the south and west have improved, with more areas being

change land raising scenario



RES-RA6.2: Wirral Waters – Vittoria Studios				
	Egend Hese Imd rating 0.5% AEP CC hazard ratings Hese Imd rating 0.5% AEP CC			
Historic flooding	There are no areas of historic flooding that affect the site according to the EA's Historic Flood Map (HFM) dataset.			
Defences	There is no known flood defence infrastructure in the vicinity of the site.			
Flood Warning Area	According to the EA's FWA dataset, there is a FWA for tidal flooding in operation for the west and a section of the east for the Irish Sea and Mersey Estuary from the Head of the Wirral to Runcorn.			
Natural Flood Management / Working with Natural Process	The site lies outside the national scale 'potential for WwNP dataset' , therefore there is no potential for natural flood management across the site.			

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RES-RA6.2: Wirral Waters – Vittoria Studios					
Flood source: infrast	ructure failure – reservoirs (res	idual)			
Flood risk: reservoir	There is no risk of flooding to the site as a result of dam failure, according to the EA's online RFM.				
Flood source: infrastructure failure – canals (residual)					
Flood risk: canal	There are no canals in the vicinity of the site.				
Flood source: surface water					
Surface Water Flo	od Risk to Proposed Devel	opment Site			
Current site: Risk of Flooding from Surface Water map	High Risk (3.3% AEP event)	Medium Risk (1% AEP event)	Low Risk (0.1% AEP event)		
	0.3%	2.6%	14.9%		
Surface water max flood depths	0.15 – 0.3 m	0.15 – 0.3 m	0.3 – 0.6 m		





Surface water flood risk to development site	Nominal risk to the site and to access routes.
Climate change	The current day 0.1% AEP event outline provides an indication of the likely increase in extent of the more frequent events. The 0.1% AEP event outline covers approximately 15% of the total site area and the extent is localised to the southern area of the site, constrained by the existing building. Duke Street to the south west of the site remains free from inundation during the 0.1% AEP event and therefore would still be viable for safe site access





Based on geological and hydrogeological information, the BGS dataset can be used to identify areas where geological conditions could enable groundwater flooding to occur and where groundwater may come close to the ground surface. The dataset should not be used on its own to make planning decisions at any scale and should not be used to inform planning decisions at the site scale. The susceptibility data cannot be used on its own to indicate risk of groundwater flooding. The dataset shows that the majority of the site is not prone to groundwater

flooding.



RES-RA6.2: Wirral Waters – Vittoria Studios				
Overall Site Assessm	nent			
Access and egress	Safe access and egress will be difficult to achieve in the long-term due to significant tidal risk.			
Recommendation summary	 Based on the evidence presented in the Level 1 SFRA and this Level 2 SFRA: Early discussions should take place with the EA with regards to the tidal flood risk issues on this site. The EA offers early engagement through an advisory service via their website (https://www.gov.uk/guidance/developers-get-environmental-advice-on-your-planning-proposals) or by emailing the local office: SPPlanning.RFH@environment-agency.gov.uk. It is recommended that this site should not be developed for residential use given the significant long-term risk with climate change. The site should remain for less vulnerable uses with resilience measures in place. Modelled land raising scenarios indicate that this could be an option to protect the site from long term tidal flooding. This should be explored at the FRA stage. No development within 8 m of The Birket/West Float. 			
Can the second part of the Exception Test be satisfied?	To pass the Exception Test, it must be proven that the site can be safe for its lifetime, which for residential development is 100 years. The climate change modelling in this Level 2 SFRA shows this will not be possible. However, land raising may be a viable option and should be explored further at the FRA stage.			
FRA requirements	 The FRA should assess the options for raised pedestrian routes to ensure safe access and egress to the site. Full consideration should be given to the impact development may have on the adjacent site RES-RA6.1. The FRA should include emergency planning procedures and ensure safe access and egress routes in times of flood. Any FRA should be carried out in line with the NPPF; FRCC-PPG; Local Plan and LLFA policies; and national and local SuDS policy and guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and the emergency services. 			
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Wirral Level 2 Strategic Flood Risk Assessment

JBA

Site RES-RA6.5

Final Report

February 2022

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Revision History

Revision Ref/Date	Amendments	Issued to
V1.0 Draft September 2021	-	John Entwistle
V2.0 Final February 2022	Council and EA comments addressed	John Entwistle

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	Assistant Analyst
Reviewed by	Mike Williamson BSc MSc CGeog FRGS EADA
	Principal Flood Risk Analyst

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RFM	Reservoir Flood Map
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
UU	United Utilities
WFD	Water Framework Directive



RES-RA6.5: Wirral Waters – Northbank East 3				
Location	Tower Road, Seacombe			
Site area (ha)	0.56			
Watercourse	The Birket/East Float			
EA Model used	Mersey Estuary 2018 (includes tidal Birket)			
Existing use	Industrial and brownfield			
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable			
Proposed use	Residential			
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable			
Proposed development impermeable area (ha)	0.48			



Figure 1: Existing fluvial and tidal flood zones, and flood risk data

This site is situated just to the north of the Main River The Birket, also referred to as the East Float dock. The eastern portion of the site is within fluvial Flood Zone 3a, according to the Flood Map for Planning. The EA has confirmed that the risk in this area is dominated by tidal risk and fluvial risk is very low. It is likely the Flood Map for Planning will be updated in due course to reflect this. The majority of the site is located within a FWA and FAA.





The elevation across the whole site does not vary substantially remaining around 7 m AOD. The area of water at East Float to the south of the site has a lower elevation of approximately 5 m AOD.

Flood Source: Tidal						
Flood Zones	Flood Zone 3b	Flood Zone 3b +climate change*	Flood Zone 3a	Flood Zone 3a +climate change*	Flood Zone 2	
	1.5%	+2.7%	42.4%	+13.7%	17.2%	
Tidal: maximum depth	Not available	N/A (within waterbody)	N/A (within waterbody)	0.6 m	Not available	
Flood Zone 3b figures stated based on defended model; Flood Zone 3a and 2 figures stated based on undefended model						

*Climate change figures based on 70th percentile (higher central allowance)

RES-RA6.5: Wirral Waters – Northbank East 3

Modelled tidal risk including climate change (Mersey Estuary 2018 model) NOTE: modelled outputs for this SFRA are subtly different to original 2018 modelled outputs due to upgraded modelling and GIS software



Figure 3: modelled tidal flood outline for present day 0.5% AEP event

NOTE: the modelling outputs presented at this site are from the Mersey Estuary 2018 coastal model only. Although Flood Zone 3 (Figure 1) on the site is stated as fluvial, the modelled outputs are tidal only, hence the difference in Flood Zone 3a in Figure 1 and the modelled tidal 0.5% AEP event outline shown above in Figure 3. However, the risk to the site in the long term is dominated by tidal flooding, as shown in Figure 4 below. The EA has also confirmed that fluvial risk in this area is very low.



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RES-RA6.5: Wirral Waters – Northbank East 3 Natural Flood Management / Working with Natural Process RE A5139 RES-RA6.5 The Birke Legend Site boundary Main Rivers WwNP Floodplain Reconnection Potential Metres 30 60 90 120 Contains Ordnance Survey data © Crown copyright and database right [2021] Figure 10: Areas identified as potential for floodplain reconnection (Working with Natural Processes) According to the national scale 'potential for WwNP dataset', the area of flood risk in the centre of the site has potential for floodplain reconnection i.e. returning this area to the floodplain for flood alleviation purposes. Observations, The proposed use of development would see a change in risk classification from mitigation less vulnerable to more vulnerable according to the NPPF. options & site Given the change in use and therefore vulnerability of the site, the developer suitability: tidal will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the Framework's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development (Para 048 Flood Risk and Coastal Change PPG). Just over 42% of the site is shown by the Flood Map for Planning to be located within fluvial Flood Zone 3a which covers the majority of the eastern area of

the site. However, the EA has confirmed that the risk in this area is dominated



RES-RA6.5: Wirral Waters – Northbank East 3					
by tida will be	I risk and fluvial risk is very low. It is likely the Flood Map for Planning updated in due course to reflect this.				
- The Me significa of 0.6m	rsey Estuary 0.5% AEP event +CC outputs indicate the entire site is at ant risk from tidal flooding in the future, with maximum depths onsite n.				
- Safe ac	ccess and egress routes must be available at times of flooding. In the				
long-te	rm, the 0.5% AEP +climate change tidal event is modelled to flood the				
A5139	to a maximum depth of 0.6 m and therefore may prove difficult for safe				
access	and egress in the future. Any access routes would have to be raised				
above t	the 0.5% AEP event +climate change maximum level. A FWA is in place				
howeve	er which should provide advanced warning for site users to evacuate				
ahead o	of a present-day flood event.				
- Given t	the modelled risk from climate change and the difficulties with access				
and eg	ress routes, it is recommended this site should not be developed for				
residen	tial use. Ideally, this site would remain for less vulnerable uses with				
approp	riate resilience measures put in place or be used as a multifunctional				
greens	bace for flood storage, amenity use and to provide				
environ	mental/ecological benefits.				
- The mo the 0.5 site fro	odelled land raising scenario indicates raising the levels of the site to % AEP +CC maximum level, plus 600mm freeboard, would protect the m tidal flooding in the long term. However, raising the site above the d level of 3.6 m would represent a considerable undertaking				
- The mo around slightly result o addition	addled depths to the south and west of the site have increased by 10mm. Depths to the north have been modelled to increase by 20-600mm. Depths to the north east have been modelled to decrease with land raising. This decrease in depths to the north east is likely a of the raised land at site RES-RA2.1 acting as a barrier to constrain hal floodwater from the east.				
- Althoug	gh land raising would be a viable option in protecting the site from tidal				
flooding	g, access and egress routes would still need to be available during				
times c	of flood, therefore raised escape route options should be investigated.				
- Stilted	development may be an option though is likely to be an expensive				
design	solution with access and egress routes also required to be above the				
design	flood level.				
- A furth	er option may be for ground floor parking or other less vulnerable uses				
(i.e. no	on-residential such as shops, restaurants, offices) and for habitable				
dwellin	gs to be situated on first floor and upwards. However, safe access and				
egress	routes must be available at times of flood, even for above ground floor				
accomr	modation.				
- A flood	risk activity permit may be required given the proximity of the site				
being v	vithin 16 metres of the tidally influenced Birket Main River. Details on				
obtainin	ng a Flood Risk Activity Permit are available from the EA. Also, the EA				
advises	against development within 8m of any watercourse to enable access				
for mai	ntenance works.				
- Based o	on the evidence stated, it is recommended that this site is not				
develop	bed and is instead used for less vulnerable uses. However, there are				
options	to allow residential development which include land raising or stilted				
develop	oment, as discussed above. In any case, safe access/egress must be				
availab	le during a flood event.				
- Were d the neig develor	evelopment of this site to proceed, given the proximity of this site to ghbouring RES-RA2.1, it would be prudent to formulate a strategy to these sites in tandem and for consultation between each developer to				



RES-RA6.5: Wirral Waters – Northbank East 3					
	take place to ensure a joined-up approach for sustainable development is in place, with consideration to the strategic solutions outlined in the Level 2 SFRA Summary Report.				
Flood source: infrast	ructure failure – reservoirs (res	sidual)			
Flood risk: reservoir	There is no risk of flooding EA's online RFM .	to the site as a result of dam	failure, according to the		
Flood source: infrastr	ructure failure – canals (residua	al)			
Flood risk: canal	There are no canals in the $ imes$	vicinity of the site.			
Flood source: surface	e water				
Surface Water Floo	od Risk to Proposed Dever	opment Site			
Current site: Risk of Flooding from	High Risk (3.3% AEP event)	Medium Risk (1% AEP event)	Low Risk (0.1% AEP event)		
Surface Water map	0%	0%	0.4%		
Surface water max flood depths	Not applicable	Not applicable	Not applicable		
Surface water flood risk to development site	Surface water risk onsite a	nd to access points is nomina	il.		
Climate change	Nominal risk as above.				
Observations, mitigation options & site suitability: surface water	 Nominal risk to site a Drainage strategy fo the LLFA. 	and access points. r the site would still be require	ed including consultation with		

RES-RA6.5: Wirral Waters – Northbank East 3

Surface Water Flood Risk from Proposed Development

Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for. For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 85% impermeable area and limiting greenfield runoff rate of Qbar (I/s).

Proposed development limiting runoff rate: (I/sec)

Obar: 3.36 l/s (assume 5 l/s minimum discharge) (FEH Statistical)

Q30: 5.72 l/s Q100: 6.99 l/s

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volum e m ³	Outflow volume m ³	Attenuation required m ³	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	4.75	258	60	198	15.7	0.013 ha 2.357 %
30yr Rainfall+40%	5.75	315	72	242	19.2	0.016 ha 2.881 %
100yr Rainfall+20%	6	369	76	294 (96 exceedance storage)	23.2	0.020 ha 3.500 %
100yr Rainfall+40%	7	444	88	356 (114 exceedance storage)	28.2	0.024 ha 4.238 %
Climate change	Application of the central (+20%) and upper end (+40%) allowances for potential change anticipated for the 2080s in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.					
Surface water: flood risk impacts from development site, mitigation & SuDS	attenuation volumes for the 1% AEP and 3.33% AEP rainfall events. As part of this Level 2 SFRA we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. Attenuation volumes are presented for the critical storm duration for the 3.33% AEP event with exceedance flows quantified up to the 1% event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.					e an estimated part of the the 3.33% prevent oust be



RES-RA6.5: Wirral Waters – Northbank East 3			
Recommendation summary	 Based on the evidence presented in the Level 1 SFRA and this Level 2 SFRA: Early discussions should take place with the EA with regards to the tidal flood risk issues on this site. The EA offers early engagement through an advisory service via their website (https://www.gov.uk/guidance/developers-get-environmental-advice-on-your-planning-proposals) or by emailing the local office: SPPlanning.RFH@environment-agency.gov.uk. It is recommended that this site should not be developed for residential use given the significant long-term risk with climate change. The site should remain for less vulnerable uses with resilience measures in place or alternatively left as open space and converted to multifunctional amenity greenspace providing flood storage and social and environmental benefits. Land raising may be a viable option to protect the site from tidal flooding in the long term. This should be explored at the FRA stage. Any consideration for development must fully investigate the options presented in this Level 2 SFRA, including for the provision of safe access and egress routes. 		
Can the second part of the Exception Test be satisfied?	To pass the Exception Test, it must be proven that the site can be safe for its lifetime, which for residential development is 100 years. The climate change modelling in this Level 2 SFRA shows this will not be possible. However, land raising may be a viable option and should be explored further at the FRA stage.		
FRA requirements	 For development to proceed, the FRA must show the development can be safe for its lifetime and must not increase risk elsewhere. Full consideration should be given to the impact development may have on the adjacent site RES-RA2.1, including any land raising. The FRA should include emergency planning procedures and ensure safe access and egress routes in times of flood. Any FRA should be carried out in line with the NPPF; FRCC-PPG; Local Plan and LLFA policies; and national and local SuDS policy and guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and the emergency services. 		

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Wirral Level 2 Strategic Flood Risk Assessment

JBA

Site RES-SA4.6

Final Report

February 2022

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JBA Project Manager

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Revision History

Revision Ref/Date	Amendments	Issued to
V1.0 Draft September 2021	-	John Entwistle
V2.0 Draft December 2021	Council and EA comments addressed	John Entwistle
V2.0 Final February 2022	-	John Entwistle

Prepared by	Maria Botterill BSc
	Analyst
Reviewed by	Mike Williamson BSc MSc CGeog FRGS EADA
	Principal Flood Risk Analyst

Purpose

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Abbreviations

AOD	Above Ordnance Datum
BGS	British Geological Survey
EA	Environment Agency
FRCC-PPG	Flood Risk and Coastal Change Planning Practice Guidance
FMfP	Flood Map for Planning
FAA	Flood Alert Area
FRA	Flood Risk Assessment
FWA	Flood Warning Area
HFM	Historic Flood Map
LIDAR	Light Detection and Radar
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
RFM	Reservoir Flood Map
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
UU	United Utilities
WFD	Water Framework Directive



RES-SA4.6, Former Croda, Bromborough Pool			
Location	Bromborough		
Site area (ha)	4.6		
Watercourse	Dibbinsdale Brook		
EA Model used	Mersey Estuary 2018 Model		
Existing use	Brownfield		
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable		
Proposed use	Residential		
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable		
Proposed development impermeable area (ha)	3.9		





Figure 1: Existing tidal flood zones and flood risk data

The site lies adjacent to the Mersey Estuary and Dibbinsdale Brook runs alongside the north and west boundary of the site. The site lies mainly within tidal Flood Zone 3a, although the boundary adjacent to the Brook is within Flood Zone 3b. A FWA and FAA are in place across the site for flooding from Dibbinsdale Brook. There is no mapped historic flooding within the vicinity of the site.



Figure 2: Topography

The elevation does not vary substantially across the site with a maximum elevation of approximately 14m AOD towards the centre of the site, and a minimum of approximately 6m AOD towards the edge of the site boundary.

Flood Source: Tidal					
Flood Zones	Flood Zone 3b	Flood Zone 3b +climate change*	Flood Zone 3a	Flood Zone 3a +climate change*	Flood Zone 2
	1.9%	+97.6%	87.4%	+12.5%	9.5%
Tidal: maximum depth	N/A	1.9 m	0.08 m	2.4 m	N/A
All figures stated based on undefended model					

*Climate change figures based on 70th percentile (higher central allowance)

RES-SA4.6, Former Croda, Bromborough Pool

Modelled tidal risk including climate change (Mersey Estuary 2018 model) NOTE: modelled outputs for this SFRA are subtly different to original 2018 modelled outputs due to upgraded modelling and GIS software



NOTE: the modelling outputs presented at this site are from the Mersey Estuary 2018 model only. The model for Dibbinsdale Brook is, at the time of writing, being updated and will not be finalised in time for this Level 2 SFRA. Therefore, the decision has been taken to use only the Mersey Estuary 2018 model to inform risk to the site at this stage. This explains why Flood Zone 3a, shown in Figure 1, is different to the 0.5% AEP event shown above in Figure 3. The majority of the present-day tidal risk to the site comes from Dibbinsdale Brook and therefore the Dibbinsdale Brook model. The risk shown in Figure 3 is therefore an underestimate.




RES-SA4.6, Former Croda, Bromborough Pool 1895 Bromborough P Legend Site boundary 0.5% AEP +CC ZUK0 hazard ratings Very low hazard Danger for some Danger for most Danger for all Metres 120 240 360 480 RES-SA4.7 Contains Ordnance Survey data © Crown copyright and database right [2021] Figure 6: modelled tidal flood hazard for 0.5% AEP +climate change event * Tidal hazard ratings based on Table 4 of the SUPPLEMENTARY NOTE ON FLOOD HAZARD RATINGS AND THRESHOLDS FOR DEVELOPMENT PLANNING AND CONTROL PURPOSE - Clarification of the Table 13.1 of FD2320/TR2 and Figure 3.2 of FD2321/TR1. May 2008. Climate change will significantly impact the entire site in the long term. Depths reach up to 2.4 m in the west of the site and flood hazards range between 'danger for most to 'danger for all' for the 0.5% AEP event plus climate change. It is also evident from Figure 4 that the potential increase in functional floodplain due to climate change is significant with a further 98% of the site at risk from a 4% AEP tidal event plus climate change. Historic flooding There is no historic flooding known to have occurred at the site. Defences There is no known flood defence infrastructure in the vicinity of the site. According to the EA's FWA dataset, there is a tidal FWA (Irish Sea and Mersey Flood Warning Estuary from the Head of the Wirral to Runcorn) in operation across the site, with Area the exception of a small area in the southeast corner of the site. Natural Flood According to the national scale 'potential for WwNP dataset', there is no potential for working with natural processes within the site. There are several areas just outside of Management /

IRA

RES-SA4.6, Former C	Croda, Bromborough Pool
Working with Natural Process	the site boundary where there is potential for floodplain reconnection.
Observations, mitigation options & site suitability: tidal	 The proposed development of the site would see a change in the risk classification from less vulnerable to more vulnerable, according to the NPPF. Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the Framework's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development (Para 048 Flood Risk and Coastal Change PPG) Present day risk is tidal and primarily from Dibbinsdale Brook. However, the Dibbinsdale Brook model is not available for this SFRA. The site boundary should be pulled back from Dibbinsdale Brook and out of the functional floodplain.
	- Given the present-day risk, the modelled risk from climate change and the difficulties with access and egress routes, it is recommended this site should not be developed for residential use. Ideally, this site would remain for less vulnerable uses with appropriate resilience measures put in place or be used as a multifunctional greenspace for flood storage, amenity use and to provide environmental/ecological benefits.
	- Land raising may be an option given the risk is tidal therefore compensatory storage would not be required. It is likely that any land raising would be required to be above the 0.5% AEP +climate change event maximum level of 2.4m plus an additional 600mm freeboard. Access and egress routes would also have to be raised and must lead to flood free areas. With the scale of land raising required this option is likely to be unfeasible.
	- Stilted development may be an option though is likely to be an expensive design solution with access and egress routes also required to be above the design flood level.
	- A further option may be for ground floor parking or other less vulnerable uses (i.e. non-residential such as shops, restaurants, offices) and for habitable dwellings to be situated on first floor and upwards. However, safe access and egress routes must be available at times of flood, even for above ground floor accommodation.
	- Safe access and egress routes must be available at times of flood and appear to be available from the east via Ashton Way, Marshall Close and Price's Way . These are located within Flood Zone 2, however a FWA is in place which should provide advanced warning for site users to evacuate ahead of a flood event.
	- A flood risk activity permit may be required as the development is within 8m of Dibbinsdale Brook. Details on obtaining a Flood Risk Activity Permit are available from the EA. The EA would also recommend no development within 8m of any watercourse to allow for access for maintenance purposes.
Flood source: infrast	ructure failure – reservoirs (residual)
Flood risk: reservoir	There is no risk of flooding to the site as a result of dam failure, according to the EA's online RFM.
Flood source: infrastr	ructure failure – canals (residual)
Flood risk: canal	There are no canals in the vicinity of this site.



Water map)



Figure 8: 1% AEP event surface water flood hazards (Risk of Flooding from Surface Water map)

*Surface water hazard rating based on Table 4.2 Hazard to People as a Function of Velocity and Depth, R&D OUTPUTS: FLOOD RISKS TO PEOPLE: PHASE 2 FD2321/TR2. Defra. March 2006.

Surface water flood risk to development site	Surface water risk is nominal. Access from the south appears achievable
Climate change	The current day 0.1% AEP event outline provides an indication of the likely increase in extent of the more frequent events. The 0.1% AEP event outline covers approximately 13% of the total site area and the extent is localised to the southern and eastern borders. Marshall Close to the south becomes partially inundated during a 0.1% AEP surface water flood event, but as depths range between 0.15 and 0.30 m, safe access and egress via this road should remain viable.
Observations, mitigation options & site suitability: surface water	 Given the size of the site, a full drainage strategy would be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. This will require surface water modelling based on proposed layout plans. Consultation with the LLFA should be carried out on surface water drainage arrangements. Safe access and egress routes from the south should be achievable.

RES-SA4.6, Former Croda, Bromborough Pool

Surface Water Flood Risk from Proposed Development

Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for. For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 85% impermeable area and limiting greenfield runoff rate of Qbar (I/s).

Proposed development limiting runoff rate: (I/sec)

Qbar: 26.86 I/s (FEH Statistical)

Q30: 45.65 l/s

Q100: 55.86 l/s

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m ³	Outflow volume m ³	Attenuation required m ³	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	7.75	2414	525	1890	27.8	0.126 ha 2.716 %
30yr Rainfall+40%	9	2908	609	2298	33.9	0.153 ha 3.302 %
100yr Rainfall+20%	9.25	3362	626	2736 (846 exceedance storage)	40.3	0.182 ha 3.931 %
100yr Rainfall+40%	10.5	4014	711	3303 (1005 exceedance storage)	48.7	0.220 ha 4.746 %
Climate change	Application of the central (+20%) and upper end (+40%) allowances for potential change anticipated for the 2080s in the table above shows the estimated attenuation volumes for the 1% AFP and 3.33% AFP rainfall events.					
Surface water: flood risk impacts from development site, mitigation & SuDS	 change anticipated for the 2080s in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events. As part of this Level 2 SFRA we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. Attenuation volumes are presented for the critical storm duration for the 3.33% AEP event with exceedance flows quantified up to the 1% event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site. 					provide an was included tion for the 1% event. To water runoff ace water runoff



RES-SA4.6, Former C	Croda, Bromborough Pool
	 This site should not be developed for residential use given the significant long-term risk with climate change. The site should remain for less vulnerable uses with resilience measures in place or alternatively left as open space and converted to multifunctional amenity greenspace providing flood storage and social and environmental benefits. No development within 8 m of the EA Main River Dibbinsdale Brook. Given that there is potential for groundwater flooding to property below ground level across the south and eastern extent of the site, it is recommended that no subsurface development is permitted. This assessment could be revisited once the Dibbinsdale Brook model has been updated. However, it is likely that risk will be further exacerbated by risk from Dibbinsdale Brook. Any consideration for development must fully investigate the options presented in this Level 2 SFRA, including for the provision of safe access and egress routes.
Can the second part of the Exception Test be satisfied?	No. To pass the Exception Test, it must be proven that the site can be safe for its lifetime, which for residential development is 100 years. The climate change modelling in this Level 2 SFRA shows this will not be possible, as the site is modelled to be inundated during a 0.5% + climate change event.
FRA requirements	 For development to proceed, the FRA must show the development can be safe for its lifetime and must not increase risk elsewhere. The FRA should assess the options for onsite land raising and other mitigation measures. The FRA should include a drainage strategy for the proposed new development layout. The FRA should include emergency planning procedures with consideration to ensuring safe access and egress routes in times of flood. Any FRA should be carried out in line with the NPPF; FRCC-PPG; Local Plan and LLFA policies; and national and local SuDS policy and guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and the emergency services.
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Wirral Level 2 Strategic Flood Risk Assessment

JBA

Site RES-SA4.7

Final Report

February 2022

www.jbaconsulting.com



JBA Project Manager

Mike Williamson JBA Consulting Second Floor Phoenix House Lakeside Drive Centre Park Warrington WA1 1RX

Revision History

Revision Ref/Date	Amendments	Issued to
V1.0 Draft	-	John Entwistle
September 2021		
V1.0 Final February		John Entwistle
2022		

Prepared by	Maria Botterill MSc
	Analyst
Reviewed by	Mike Williamson BSc MSc CGeog FRGS EADA
	Principal Flood Risk Analyst

Purpose

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Abbreviations

AOD	Above Ordnance Datum
BGS	British Geological Survey
EA	Environment Agency
FRCC-PPG	Flood Risk and Coastal Change Planning Practice Guidance
FMfP	Flood Map for Planning
FAA	Flood Alert Area
FRA	Flood Risk Assessment
FWA	Flood Warning Area
HFM	Historic Flood Map
LIDAR	Light Detection and Radar
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
RFM	Reservoir Flood Map
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
UU	United Utilities
WFD	Water Framework Directive

RES-SA4.7 – SHLAA	4021 Land Off Dock Road South, Bromborough	
Location	Bromborough	
Site area (ha)	22.7	
Watercourse	Mersey Estuary	
EA Model used	Mersey Estuary 2018 Model	
Existing use	Brownfield	
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable	
Proposed use	Residential	
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable	
Proposed development impermeable area (ha)	19.3	



RES-SA4.7 – SHLAA 4021 Land Off Dock Road South, Bromborough

Figure 1: Existing tidal flood zones and flood risk data

The site lies adjacent to the Mersey Estuary. The majority of the site is situated within Flood Zone 1, with the exception of the northern extent in tidal Flood Zone 2 (with a small proportion falling within tidal Flood Zone 3). The site itself is not within a Flood Warning Area or Flood Alert Area, but these areas are adjacent to the eastern boundary of the site. There is no historic flooding mapped within the vicinity of the site.



Figure 2: Topography

The elevation varies across the site. The topography at the north and east is relatively flat with elevation ranging from approximately 7m to 10m AOD. Towards the west and south of the site there are multiple raised mounds with crests ranging between approximately 13m and 17m AOD. There are tracks inbetween the mounds at a lower elevation (approximately 10m AOD).

Flood Source: Tidal					
Flood Zones	Flood Zone 3b	Flood Zone 3b +climate change*	Flood Zone 3a	Flood Zone 3a +climate change*	Flood Zone 2
	0%	+29.7%	2.6%	+37.6%	16.0%
Tidal: maximum depth	N/A	1.0 m	0.5 m	1.5 m	N/A

All figures stated based on undefended model

*Climate change figures based on 70th percentile (higher central allowance)

RES-SA4.7 – SHLAA 4021 Land Off Dock Road South, Bromborough

Modelled tidal risk including climate change for the Mersey Estuary (Mersey Estuary 2018 model) NOTE: modelled outputs for this SFRA are subtly different to original 2018 modelled outputs due to upgraded modelling and GIS software



Note: Modelled baseline flood extents for the 0.5% AEP event vary slightly from the existing Flood Zone 3a outlines. This is a result of the existing flood zones using the old Coastal Flood Boundaries (CFB) from 2011 and the model having a base year of 2015. The previous CFB excluded data from the Class A gauge at Liverpool due to differences with the surrounding gauges at Heysham and Hilbre Island. The new CFB in 2018 included gauge data from Liverpool and an uplift was added to get the model to a base year of 2021, meaning the levels at the mouth of the estuary increased by over 0.3m causing additional flooding to certain areas.

The current Flood Map for Planning therefore will underestimate present day tidal flood risk to the Wirral. The tidal models should be updated with the new CFB data.









RES-SA4.7 – SHLAA	4021 Land Off Dock Road South, Bromborough
Observations, mitigation	- The proposed use of the site would see a change in the risk classification from less vulnerable to more vulnerable, according to the NPPF.
options & site suitability: tidal	 Given the change in use vanished of the value ability of the site, the developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the Framework's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development (Para 048 Flood Risk and Coastal Change PPG). The majority of this site is suitable for development. Development should be directed to Flood Zone 1 and the area outside of the climate change risk area shown in Figures 6 and 7. The modelling also shows the potential expansion of the functional floodplain across the site by way of the 4% AEP +climate change event outline in Figure 5. Ideally, the area at risk from climate change should be left as open space and used as multifunctional greenspace for flood storage, amenity use and to provide environmental/ecological benefits. However, given the risk is tidal and the site borders the Mersey Estuary, land raising may be possible in this area without the need for compensatory storage. It is likely that any land raising would be required to be above the 0.5% AEP +climate change event maximum level of 1.5m plus an additional 600mm freeboard. Access and egress routes appear to be available from the southeast of the site via Riverbank Road. The EA recommend for an 8m no development buffer alongside any watercourse to allow for maintenance access. Also, a flood risk activity permit may be required as the site is within 16 metres of the tidally influence Mersey Estuary. Details on obtaining a Flood Risk Activity Permit are available from the EA.
Flood source: infrast	ructure failure – reservoirs (residual)
Flood risk: reservoir	There is no risk of flooding to the site as a result of dam failure, according to the EA's online RFM.
Flood source: infrastr	ucture failure – canals (residual)
Flood risk: canal	There are no canals in the vicinity of this site.
2021s1045 Wirral	Level 2 SFRA - Site RES-SA4.7 v1.0 9





Figure 9: 1% AEP event surface water flood hazards (Risk of Flooding from Surface Water map)

* Surface water hazard rating based on Table 4.2 Hazard to People as a Function of Velocity and Depth, R&D OUTPUTS: FLOOD RISKS TO PEOPLE: PHASE 2 FD2321/TR2. Defra. March 2006.

Surface water flood risk to development site	Nominal risk primarily localised to small areas in the centre of the site. Safe access and egress achievable at multiple locations around the site.
Climate change	The current day 0.1% AEP event outline provides an indication of the likely increase in extent of the more frequent events. The 0.1% AEP event outline covers approximately 11% of the total site area and the extent is localised to the north and east of the site where the tidal risk is concentrated. Safe access and egress should remain viable via The Power Station road or Dock Road South.
Observations, mitigation options & site suitability: surface water	 Given the large size of the site, a detailed drainage strategy would be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. This will require surface water modelling based on proposed layout plans and consultation with the LLFA.

RES-SA4.7 – SHLAA 4021 Land Off Dock Road South, Bromborough

Surface Water Flood Risk from Proposed Development

Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for. For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 85% impermeable area and limiting greenfield runoff rate of Qbar (I/s).

Proposed development limiting runoff rate: (I/sec)

Qbar: 129.61 I/s (FEH Statistical)

Q30: 220.33 l/s

Q100: 269.58 l/s

Critical storm duration Hrs	Inflow volum e m ³	Outflow volume m ³	Attenuation required m ³	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area	
8	11884	2613	9271	28.3	0.618 ha 2.724 %	
9.25	14303	3021	11282	34.4	0.752 ha 3.315 %	
9.25	16471	3021	13450 (4179 exceedance storage)	41.1	0.897 ha 3.952 %	
10.75	19746	3511	16235 (4953 exceedance storage)	49.6	1.082 ha 4.770 %	
Application of the central (+20%) and upper end (+40%) allowances for potential change anticipated for the 2080s in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.						
attenuation volumes for the 1% AEP and 3.33% AEP rainfall events. As part of this Level 2 SFRA we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. Attenuation volumes are presented for the critical storm duration for the 3.33% AEP event with exceedance flows quantified up to the 1% event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.						
	Critical storm duration Hrs 8 9.25 9.25 10.75 Application o change antic attenuation of As part of thi land take if a development Attenuation of AEP event wi development managed on	Critical storm duration HrsInflow volum e m³8118849.25143039.251647110.7519746Application of the centra change anticipated for t attenuation volumes for As part of this Level 2 S land take if a pond with development.Attenuation volumes ar AEP event with exceeda development worsening managed on site.	Critical storm duration HrsInflow volum e m³Outflow volume m³81188426139.251430330219.2516471302110.7519746351110.75197463511Application of the central (+20%) an change anticipated for the 2080s in t attenuation volumes for the 1% AEPAs part of this Level 2 SFRA we have land take if a pond with an assumed development.Attenuation volumes are presented for AEP event with exceedance flows quad development worsening flood risk els managed on site.	Critical storm duration HrsInflow volum e m³Outflow volume m³Attenuation required m³811884261392719.25143033021112829.2516471302113450 (4179 exceedance storage)10.7519746351116235 (4953 exceedance storage)Application of the central (+20%) and upper end (+4 change anticipated for the 2080s in the table above s attenuation volumes for the 1% AEP and 3.33% AEPAs part of this Level 2 SFRA we have included calcula land take if a pond with an assumed depth of 1.5m w development.Attenuation volumes are presented for the critical sto AEP event with exceedance flows quantified up to the development worsening flood risk elsewhere, surface managed on site.	Critical storm duration HrsInflow volum e m³Outflow volume 	Critical storm duration HrsInflow volum e m³Outflow volume m³Attenuation required m³Time to empty (assuming no infiltration) HrsTotal storage required: Area (ha) and % of site area8118842613927128.30.618 ha 2.724 %9.251430330211128234.40.752 ha 3.315 %9.2516471302113450 (4179 exceedance storage)41.10.897 ha 3.952 %10.7519746351116235 (4953 exceedance storage)49.61.082 ha 4.770 %Application of the central (+20%) and upper end (+40%) allowances for potential change anticipated for the 2080s in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.1.082 ha 4.770 %As part of this Level 2 SFRA we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development.3.33% AEP event with exceedance flows quantified up to the 1% event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.





RES-SA4.7 – SHLAA 4021 Land Off Dock Road South, Bromborough	
	greenspace - A detailed drainage strategy should be carried out.
Can the second part of the Exception Test be satisfied?	Yes, assuming the above recommendations are fully considered.
FRA requirements	 The FRA should assess storage volumes for the recommended greenspace and design as required. The FRA should include a drainage strategy for the proposed new development layout. The FRA should include emergency planning procedures with consideration to ensuring safe access and egress routes in times of flood. Any FRA should be carried out in line with the NPPF; FRCC-PPG; Local Plan and LLFA policies; and national and local SuDS policy and guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and the emergency services.
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Wirral Level 2 Strategic Flood Risk Assessment

JBA

Site RES-SA4.10

Final Report

February 2022

www.jbaconsulting.com



JBA Project Manager

Mike Williamson JBA Consulting Second Floor Phoenix House Lakeside Drive Centre Park Warrington WA1 1RX

Revision History

Revision Ref/Date	Amendments	Issued to
V1.0 Draft September 2021	-	John Entwistle
V2.0 Draft December 2021	Council and EA comments addressed	John Entwistle
V2.0 Final February 2022	-	John Entwistle

Prepared by	Laura Thompson BSc
	Assistant Analyst
Reviewed by	Mike Williamson BSc MSc CGeog FRGS EADA
	Principal Flood Risk Analyst

Purpose

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Abbreviations

AOD	Above Ordnance Datum
BGS	British Geological Survey
EA	Environment Agency
FRCC-PPG	Flood Risk and Coastal Change Planning Practice Guidance
FMfP	Flood Map for Planning
FAA	Flood Alert Area
FRA	Flood Risk Assessment
FWA	Flood Warning Area
HFM	Historic Flood Map
LIDAR	Light Detection and Radar
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
RFM	Reservoir Flood Map
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
UU	United Utilities
WFD	Water Framework Directive

RES-SA4.10: SHLAA	4088 - Maple Grove, Bromborough, Wirral	
Location	Bromborough, Wirral	
Site area (ha)	0.14	
Watercourse	None	
EA Model used	N/A	
Existing use	Brownfield	
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable	
Proposed use	Residential	
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable	
Proposed development impermeable area (ha)	0.12	





Figure 2: Topography

As it's a small site, the elevation does not vary substantially. The topography generally slopes westwards, however the elevation is approx. between 30 and 31 mAOD across the whole site.

Historic flooding	According to the EA's Historic Flood Map, there are no known flooding events that have occurred within the vicinity of the site.
Defences	There is no known flood defence infrastructure in the vicinity of the site.
Flood Warning Area	According to the EA's FWA dataset, there are no known Flood Warning Areas within the vicinity of the site.
Natural Flood Management / Working with Natural Process	According to the national scale 'potential for WwNP dataset', there are no opportunities for Natural Flood Management within the site boundary. To the south-west of the site, there is some potential for flood risk mitigation through planting riparian woodland to attenuate flow.



RES-SA4.10: SHLAA 4088 - Maple Grove, Bromborough, Wirral			
Observations, mitigation options & site suitability: fluvial	 The site falls within Flood Zone 1 and is therefore at very low risk from fluvial and/or tidal flooding. Safe access and egress routes must be available at times of flood and appear to be available from Maple Grove. 		
Flood source: infrast	ructure failure – reservoirs (res	idual)	
Flood risk: reservoir	There is no risk of flooding to the site as a result of dam failure, according to the EA's online RFM.		
Flood source: infrastr	ucture failure – canals (residua	l)	
Flood risk: canal	There are no canals in the vi	cinity of this site.	
Flood source: surface	e water		
Surface Water Flo	od Risk to Proposed Develo	opment Site	
Current site: Risk of Flooding from Surface Water	High Risk (3.3% AEP event) 16.1%	Medium Risk (1% AEP event) 26%	Low Risk (0.1% AEP event) 39.1%
Surface water max flood depths	0.15 – 0.3 m	0.15 – 0.3 m	0.3 – 0.6 m





Figure 4: 1% AEP event surface water flood hazards (Risk of Flooding from Surface Water map)

*Surface water hazard rating based on Table 4.2 Hazard to People as a Function of Velocity and Depth, R&D OUTPUTS: FLOOD RISKS TO PEOPLE: PHASE 2 FD2321/TR2. Defra. March 2006.

Surface water flood risk to development site	Approximately 26% of the site is at risk of surface water flooding in the 1% AEP event to a maximum depth of between 0.3 and 0.6 m, with areas of low and moderate hazard. The risk in all events is primarily localised to a flow route in the central area of the site. Based on the 1% AEP outline, safe access and egress may be difficult to achieve during a flood event with depths along Maple Grove and Beechwood Road reaching 0.15 – 0.3 m.
Climate change	The current day 0.1% AEP event outline provides an indication of the likely increase in extent of the more frequent events. The 0.1% AEP event outline covers almost 40% of the total site area, covering the northern and western site boundaries, and the central section of the site. Maple




RES-SA4.10: SHLAA 4088 - Maple Grove, Bromborough, Wirral

Surface Water Flood Risk from Proposed Development

Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for. For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 85% impermeable area and limiting greenfield runoff rate of Qbar (I/s).

Proposed development limiting runoff rate: (I/sec)

Qbar: 0.67 I/s (FEH Statistical)

Q30: 1.14 l/s

Q100: 1.4 l/s

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volum e m ³	Outflow volume m ³	Attenuation required m ³	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	1	44	13	32	2.5	0.002 ha 1.524 %
30yr Rainfall+40%	1.25	55	16	39	3.1	0.003 ha 1.857 %
100yr Rainfall+20%	1.25	65	16	49 (17 exceedanc e storage)	3.9	0.003 ha 2.333 %
100yr Rainfall+40%	1.5	79	19	60 (21 exceedanc e storage)	4.8	0.004 ha 2.857 %
Climate change	Application o change antic attenuation v	f the centra pated for t olumes for	al (+20%) and the 2080s in the the 1% AEP a	upper end (+4 e table above s nd 3.33% AEP	0%) allowance hows the estim rainfall events.	s for potential ated
Surface water: flood risk impacts from development site, mitigation & SuDS	As part of thi land take if a development Attenuation v AEP event wi development managed on	s Level 2 S pond with /olumes ar th exceeda worsening site.	FRA we have in an assumed do e presented for ince flows quar flood risk else	ncluded calcula epth of 1.5m w the critical sto tified up to the where, surface	tions to provide as included as orm duration for e 1% event. To water runoff m	e an estimated part of the the 3.33% prevent oust be





RES-SA4.10: SHLAA	4088 - Maple Grove, Bromborough, Wirral
	 greenspace which could be engineered into a formal flood storage area. Another option could be to direct less vulnerable uses, such as employment, to this site rather than more vulnerable residential uses. If development is to be considered at this site, detailed surface water modelling should be carried out post site clearance and pre-development to ascertain natural flow paths and depressions.
Can the second part of the Exception Test be satisfied?	Site not subject to the Exception Test though development may be permitted assuming it can be shown that surface water risk can be mitigated effectively onsite and included within the site design. If not, development of this site should not be permitted.
FRA requirements	 Further modelling of surface water risk pre and post development options should be carried out. The FRA should include a drainage strategy for the proposed new development layout if modelling shows the site might be deliverable. Consultation with the LLFA should be carried out on surface water drainage arrangements. Any FRA should be carried out in line with the NPPF; FRCC-PPG; Local Plan and LLFA policies; and national and local SuDS policy and guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and the emergency services.

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Wirral Level 2 Strategic Flood Risk Assessment

JBA

Site RES-SA5.3

Final Report

February 2022

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Revision History

Revision Ref/Date	Amendments	Issued to
V1.0 Draft September 2021	-	John Entwistle
V2.0 Draft December 2021	Council and EA comments addressed	John Entwistle
V2.0 Final February 2022	-	John Entwistle

Prepared by	Hannah Bishop BSc MSc
	Assistant Analyst
Reviewed by	Mike Williamson BSc MSc CGeog FRGS EADA
	Principal Flood Risk Analyst

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FWA	Flood Warning Area
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LIDAR	Light Detection and Radar
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
RFM	Reservoir Flood Map
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
UU	United Utilities
WFD	Water Framework Directive



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52	
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Figure 1: Existing fluvial / tidal flood zones and flood risk data

The Main River The Birket flows eastwards to the north of the site. The site is entirely located within Flood Zone 3a which the Flood Map for Planning states is tidal risk. There is also fluvial risk to the surrounding areas from The Birket. There are two FWAs and two FAAs covering the entirety of the site. The entire site is covered by an ABD for the Wallasey Embankment. The Shoreline Management Plan policy for this stretch of coastline is to Hold the Line.



Figure 2: Topography

The elevation across the whole site does not vary substantially ranging between 3.5 m AOD in the south west corner to approximately 5 m AOD in the east.



RES-SA5.3: East of T	yphoo, Moreton				
Flood Source: Fluvia	l / Tidal				
Flood Zones	Flood Zone 3b	Flood Zone 3b +climate change*	Flood Zone 3a	Flood Zone 3a +climate change*	Flood Zone 2
	0%	+0%	100%	+0%	0%
Fluvial: maximum depth	N/A	N/A	0.1 m	0.5 m	0.8 m
Tidal: maximum depth	Not available	N/A	1.9 m	2.9 m	Not available
Flood Zone 3b figur undefended model	es stated based or	n defended model	; Flood Zone 3a a	and 2 figures state	ed based on

*Fluvial climate change figures based on central allowance (+44% on peak flows)

*Tidal climate change figures based on higher central allowance (70th percentile)

RES-SA5.3: East of Typhoo, Moreton

Modelled tidal risk including climate change (Wirral Tidal 2015 model) NOTE: modelled outputs for this SFRA are subtly different to original 2015 modelled outputs due to upgraded modelling and GIS software

































RES-SA5.3: East of T	yphoo, Moreton
Defences	On the right bank of the Birket, which is closest to the site, there is an embankment that spans the length of the north site boundary which has a design standard of 100 and a condition grade of 3 meaning Fair (Table 1.1 Condition Assessment Manual 2012 ¹). There are also two flood walls on the right bank of the Birket where it passes under Reeds Lane which have design standards of 100 and condition grades of 3. It is unknown if these defences provide protection to the site.
	The whole site lies within the EA's A BD polygon, protected from tidal flooding by the Wallasey Embankment along the north coast of the Wirral. The Wallasey embankment is a Council owned defence with a design standard of 200 and a condition grade of 2 meaning Good. As shown above, the site is at residual risk in the long term were the Embankment to be breached.
	The SMP policy is to Hold the Line, therefore the long-term strategy is for the defences to be adequately maintained and upgraded to maintain the status quo. It would be expected therefore that investment in these defences will continue in the long term.
Flood Warning Area	According to the EA's FWA dataset, there are two FWAs in operation that cover the entire site. One for the River Birket at Leasowe with areas at risk including Pasture Lane, Taran Way North, and Ditton Lane with properties at risk off Reed Lane at Reedville Grove, Cornflower Way and Bullrush Drive. The other FWA covers the Irish Sea and Mersey Estuary from the Head of the Wirral to Runcorn affecting areas of Hoylake, Meols, Moreton and Wallasey.

 $1\ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291126/scho0509bqat-e-e.pdf$

RES-SA5.3: East of Typhoo, Moreton





RES-SA5.3: East of Typhoo, Moreton

Observations,
mitigation
options & site
suitability: tidal
and fluvial

The proposed use of development would see a change in risk classification from less vulnerable to more vulnerable according to the NPPF.

- Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the **Framework's policy on flood risk.** For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development (Para 048 Flood Risk and Coastal Change PPG).
- The whole site is at flood risk from Flood Zone 3a and is at significant risk from climate change. According to the Flood Map for Planning, the risk is tidal but there is also risk to the surrounding area from The Birket which is a combination of fluvial and tidal risk. The site is protected the Council owned coastal Wallasey embankment and is within an ABD for the Wallasey embankment.
- In mapping ABDs, the EA assumes that flood defences and other operating structures act perfectly and give the same level of protection as when the previous assessment of the area was made. Consultation with the LLFA on the condition and maintenance arrangements of the Wallasey Embankment should be carried out however it would be expected, given the SMP policy of 'hold the line' that investment in the defences will continue in the long term.
- Parts of the site are modelled to flood during the fluvial 1% AEP + climate change event to a maximum depth of 0.5 m according to the Birket Fender and Arrowe Brook model.
- According to the EA's Spatial Flood Defences dataset, the defences on The Birket are in fair condition and may have defects that could reduce performance of the asset. It is unknown if the defences on The Birket provide protection to the site. The EA should be consulted as to the actual condition of these defences and should provide any details on possible refurbishment or replacement.
- The site is not at residual risk from the present day 0.5% AEP breach scenario from the Wallasey embankment but in the long term from climate change the whole site is impacted to a maximum depth of 2.3 m and a hazard rating of Danger to All.
- Safe access and egress are not considered to be achievable based on the Wirral Tidal model present day 0.5% AEP outline due to total inundation of Reeds Lane and depths around 1.6 m.
- Given the modelled risk from climate change and the difficulties with access and egress routes, it is recommended this site should not be developed for residential use. Ideally, this site would remain for less vulnerable uses with appropriate resilience measures put in place or be left as open space and used as a multifunctional greenspace for flood storage, amenity use and to provide environmental/ecological benefits.
- The modelled land raising scenario indicates raising the levels of the site to the 0.5% AEP +CC maximum level, plus 600mm freeboard, would protect the site from tidal flooding in the long term. However, raising the site above the required level of 3.6 m would represent a considerable undertaking.
- The modelled depths within sites EMP-SA5.3 and EMP-SA5.2 have increased with the raising of the land within site RES-SA5.3. Depths to the south and within site EMP-SA5.1 have been modelled to decrease when compared to the baseline.
- Although land raising would be a viable option in protecting the site from tidal flooding, access and egress routes would still need to be available during times



RES-SA5.3: East of Typhoo, Moreton			
Flood source: infrast	ructure failure – reservoirs (res	idual)	
Flood risk: reservoir	There is no risk of flooding to the site as a result of dam failure, according to the EA's online RFM.		
Flood source: infrast	ructure failure – canals (residua	l)	
Flood risk: canal	There are no canals in the vicinity of the site.		
Flood source: surface	e water		
Surface Water Flo	od Risk to Proposed Devel	opment Site	
Current site: Risk of Flooding from	High Risk (3.3% AEP event)	Medium Risk (1% AEP event)	Low Risk (0.1% AEP event)
Surface Water map	0.4%	1.4%	11.1%
Surface water max flood depths	0.6 – 0.9 m	0.6 – 0.9 m	0.6 – 0.9 m





Surface Water map)

* Surface water hazard rating based on Table 4.2 Hazard to People as a Function of Velocity and Depth, R&D OUTPUTS: FLOOD RISKS TO PEOPLE: PHASE 2 FD2321/TR2. Defra. March 2006.

Surface water flood risk to development siteSurface water risk to the site is minimal. Safe access and egress would be achievable via Reeds Lane to the east of the site as this section of road remains free from inundation during the 1% AEP event.
--

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RES-SA5.3: East of	Typhoo, Moreto	'n				
Climate change	The current day 0.1% AEP event outline provides an indication of the likely increase in extent of the more frequent events. The 0.1% AEP event outline covers approximately 11% of the total site area and the extent is localised to the south west corner of the site. Reeds Lane becomes more inundated during the 0.1% AEP event with average depths between 0.15 and 0.3 m and the hazard being classed as Low and therefore safe access and egress should be viable via Reeds Lane.					
Observations, mitigation options & site suitability: surface water	 A drainage strategy would be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. This will require consultation with the LLFA. 					
Surface Water Fl	ood Risk fron	n Proposed	d Developmen	ot		
Runoff rates should aimed for. For the calculated below ba (I/s).	I not exceed cu purposes of th ased on an ass	urrent rates his assessm umed 85%	and if possible ent, the require impermeable a	e, betterment of ed volumes of a area and limiting	existing rates itenuation hav greenfield rur	should be e been noff rate of Qbar
Proposed developm Qbar: 12.98 l/s (FE Q30: 22.07 l/s Q100: 27 l/s	ent limiting ru H Statistical)	noff rate: (I	l/sec)			
Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volum e m ³	Outflow volume m ³	Attenuation required m ³	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	10.5	1710	343	1367	41.7	0.091 ha 2.959 %
30yr Rainfall+40%	12	2048	393	1655	50.5	0.110 ha 3.582 %
100yr Rainfall+20%	11.5	2311	376	1935 (568 exceedance storage)	59	0.129 ha 4.188 %
100yr Rainfall+40%	12*	2714	393	2322 (667 exceedance storage)	70.8	0.155 ha 5.026 %
*limited to a 12 hr	critical storm					
Climate change	Application of the central (+20%) and upper end (+40%) allowances for potential change anticipated for the 2080s in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.					

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RES-SA5.3: East of Typhoo, Moreton		
Overall Site Assessm	nent	
Access and egress	Safe access and egress are not achievable. However, the EA's flood warning system that is in place should ensure site users can evacuate the site ahead of any potential flood event in the short term. However, the modelled impact from climate change is severe and safe escape routes will be difficult to achieve. Any FRA for the site must include an Emergency Plan focused on the timely evacuation of site users ahead of any flood event occurring.	
Recommendation summary	 Based on the evidence presented in the Level 1 SFRA and this Level 2 SFRA: Early discussions should take place with the EA with regards to the tidal and fluvial flood risk issues on this site. The EA offers early engagement through an advisory service via their website (https://www.gov.uk/guidance/developers-get-environmental-advice-on-your-planning-proposals) or by emailing the local office: SPPlanning.RFH@environment-agency.gov.uk. It is recommended that this site should not be developed for residential use. Ideally, this site would remain for less vulnerable uses with appropriate resilience measures put in place or be cleared and used as a multifunctional greenspace for flood storage, amenity use and to provide environmental/ecological benefits. However, land raising could be a viable option to protect the site from tidal flooding in the long term and should be explored at the FRA stage. Land raising at this site should be investigated to ensure existing residential development to the west of the site is not adversely impacted from the land raising.Any consideration for development must fully investigate the options presented in this Level 2 SFRA, including for the provision of safe access and egress routes. 	
Can the second part of the Exception Test be satisfied?	To pass the Exception Test, it must be proven that the site can be safe for its lifetime, which for residential development is 100 years. The modelling in this Level 2 SFRA shows this will not be possible. However, land raising may be a viable option and should be explored further at the FRA stage.	
FRA requirements	 For development to proceed, the FRA must show the development can be safe for its lifetime and must not increase risk elsewhere. Full consideration should be given to the impact development may have on the adjacent sites EMP-SA5.2, EMP-SA5.3 and EMP-SA5.1 Any FRA should be carried out in line with the NPPF; FRCC-PPG; Local Plan and LLFA policies; and national and local SuDS policy and guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and the emergency services. 	
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Wirral Level 2 Strategic Flood Risk Assessment

JBA

Site RES-SA5.5

Final Report

February 2022

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Revision History

Revision Ref/Date	Amendments	Issued to
V1.0 Draft	-	John Entwistle
September 2021		
V1.0 Final February	-	John Entwistle
2022		

Prepared by	Laura Thompson BSc
	Assistant Analyst
Reviewed by	Mike Williamson BSc MSc CGeog FRGS EADA
	Principal Flood Risk Analyst

Purpose

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Abbreviations

AOD	Above Ordnance Datum
BGS	British Geological Survey
EA	Environment Agency
FRCC-PPG	Flood Risk and Coastal Change Planning Practice Guidance
FMfP	Flood Map for Planning
FAA	Flood Alert Area
FRA	Flood Risk Assessment
FWA	Flood Warning Area
HFM	Historic Flood Map
LIDAR	Light Detection and Radar
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
RFM	Reservoir Flood Map
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
UU	United Utilities
WFD	Water Framework Directive



RES-SA5.5: SHLAA	4014 The Stirrup, Arrowe Park Road	
Location	Upton, Wirral	
Site area (ha)	0.37	
Watercourse	None	
EA Model used	N/A	
Existing use	Brownfield	
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable	
Proposed use	Residential	
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable	
Proposed development impermeable area (ha)	0.31	



Figure 1: Existing fluvial flood zones and flood risk data

According to the Environment Agency's flood risk datasets, there is no known fluvial or tidal flood risk to the site. The site is wholly within Flood Zone 1.



Figure 2: Topography

The elevation does not vary substantially across the site. The topography generally slopes eastwards from higher ground of approx. 39 m AOD at the western site boundary down to around 38 m AOD at the eastern boundary.

_	
Historic flooding	According to the EA's Historic Flood Map, there are no known flooding events that have occurred within the vicinity of the site.
Defences	There is no known flood defence infrastructure in the vicinity of the site.
Flood Warning Area	According to the EA's FWA dataset, there are no known Flood Warning Areas within the vicinity of the site.
Natural Flood Management / Working with Natural Process	There are no opportunities for Natural Flood Management within the vicinity of the site.



RES-SA5.5: SHLAA	1014 The Stirrup, Arrowe Park Ro	oad		
Observations, mitigation options & site suitability: fluvial/tidal	 The site falls within Flood Zone 1, with no modelled or observed fluvial or tidal flood risk, indicating very low fluvial and tidal flood risk to the site. Safe access and egress routes must be available at all times and appear to be available from Arrowe Park Road and Fletcher Close. 			
Flood source: infrast	tructure failure – reservoirs (resi	dual)		
Flood risk: reservoir	There is no risk of flooding to the site as a result of dam failure, according to the EA's online RFM.			
Flood source: infrast	ructure failure – canals (residua	I)		
Flood risk: canal	There are no canals in the vicinity of this site.			
Flood source: surface	e water			
Surface Water Flo	od Risk to Proposed Develo	opment Site		
Current site: Risk of Flooding from	High Risk (3.3% AEP event)	Medium Risk (1% AEP event)	Low Risk (0.1% AEP event)	
Surface Water map	5.4%	10.3%	25.7%	
Surface water max flood depths	0.15 – 0.3 m	0.15 – 0.3 m	0.3 – 0.6 m	



Figure 3: 1% AEP event surface water flood depths (Risk of Flooding from Surface Water map)



Figure 4: Surface water flood hazards (Risk of Flooding from Surface Water map)

* Surface water hazard rating based on Table 4.2 Hazard to People as a Function of Velocity and Depth, R&D OUTPUTS: FLOOD RISKS TO PEOPLE: PHASE 2 FD2321/TR2. Defra. March 2006.

Surface water flood risk to development site	Approximately 10% of the site is at risk of surface water flooding in the 1% AEP event to a maximum depth of between 0.15 and 0.3, with areas of low to moderate hazard. The risk in all events is primarily localised to the western boundary of the site. The land here is low-lying industrial brownfield land.
Climate change	The current day 0.1% AEP event outline provides an indication of the likely increase in extent of the more frequent events. The 0.1% AEP event outline covers approximately 25% of the total site area and the extent is localised to the low-lying brownfield area in the east. Arrowe Park Road to the west becomes partially inundated but as depths range between 0 and 0.3 m where inundated, safe access and egress via this road should remain viable. Access/egress via Fletcher Close will not be viable during the 0.1% AEP event as it

RES-SA5.5: SHLAA	4014 The Stirrup, Arrowe Park Road
	becomes inundated with depths between 0.3 to 0.6 m.
Mitigation options & site suitability: surface water	 Development should avoid the low-lying area to the east of the site and be focussed to the west of the site where there is nominal surface water flood risk. The area along the eastern boundary should be left as greenspace, designed to flood during flood events. SuDS such as a swale could be used to contain surface water here though ground investigation required. Assessment of the current drainage system in place should be carried out to ascertain any current capacity issues and whether the current system could accommodate the proposed residential development or whether further capacity will be required. A drainage strategy may be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development. Consultation with the LLFA will be required.
Surface Water Flo	ood Risk from Proposed Development

Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for. For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 85% impermeable area and limiting greenfield runoff rate of Qbar (I/s).

Proposed development limiting runoff rate: (I/sec) Qbar: 1.57 I/s (FEH Statistical)

Q100: 3.27 l/s	

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volum e m ³	Outflow volume m ³	Attenuation required m ³	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	3	155	38	117	9.2	0.008 ha 2.108 %
30yr Rainfall+40%	3.75	191	47	143	11.3	0.010 ha 2.577 %
100yr Rainfall+20%	4	224	50	174 (57 exceedanc e storage)	13.8	0.012 ha 3.135 %
100yr Rainfall+40%	4.75	272	60	212 (69 exceedanc e storage)	16.8	0.014 ha 3.820 %
Climate change	Application of the central (+20%) and upper end (+40%) allowances for potential change anticipated for the 2080s in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.				s for potential ated	
Surface water: flood risk impacts from development site, mitigation & SuDS	As part of this Level 2 SFRA we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. Attenuation volumes are presented for the critical storm duration for the 3.33% AEP event with exceedance flows quantified up to the 1% event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.					



RES-SA5.5: SHLAA	4014 The Stirrup, Arrowe Park Road
Flood Source: Grour	ndwater
Flood risk: groundwater	Based on geological and hydrogeological information, the BGS dataset can be used to identify areas where geological conditions could enable groundwater flooding to occur and where groundwater may come close to the ground surface. The dataset should not be used on its own to make planning decisions at any scale and should not be used to inform planning decisions at the site scale. The susceptibility data cannot be used on its own to indicate risk of groundwater flooding. The dataset shows that the site is considered not prone to groundwater flooding.
Overall Site Assessm	nent
Access and egress	Based on the risk presented, safe access and egress routes should be possible to the west of the site via Arrowe Park Road. Safe routes to and from the east may prove challenging.
Recommendation summary	 Based on the evidence presented in the Level 1 SFRA and this Level 2 SFRA: Early consultation with the LLFA should carried out regarding surface water flood risk control and mitigation onsite. Development should be preferentially sited away from the eastern boundary of the site susceptible to surface water flooding. Investigation into appropriate SuDS options should be explored to accommodate the onsite risk.
Can the second part of the Exception Test be satisfied?	Site not subject to the Exception Test though development may be permitted assuming it can be shown that surface water risk can be mitigated effectively onsite and included within the site design. If not, development of this site should not be permitted.
FRA requirements	 A drainage strategy should be produced in consultation with the LLFA. Any site-specific work should be carried out in line with the NPPF; FRCC-PPG; Local Plan and LLFA policies; and national and local SuDS policy and guidelines. Consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and the emergency services.
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Wirral Level 2 Strategic Flood Risk Assessment

JBA

RES-SA5.6

Final Report

February 2022

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Revision History

Revision Ref/Date	Amendments	Issued to
V1.0 Draft September 2021	-	John Entwistle
V2.0 Draft December 2021	Council and EA comments addressed	John Entwistle
V2.0 Final February 2022	-	John Entwistle

Prepared by	Hannah Bishop BSc MSc
	Analyst
Reviewed by	Mike Williamson BSc MSc CGeog FRGS EADA
	Principal Flood Risk Analyst

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SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
UU	United Utilities
WFD	Water Framework Directive



RES-SA5.6: SHLAA	5146 Land at Twickenham Drive	
Location	Leasowe	
Site area (ha)	0.76	
Watercourse	The Birket and coastal	
EA Model used	Birket Fender Fluvial Model 2011 / Wirral Tidal Model 2015	
Existing use	Greenfield and car park	
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable	
Proposed use	Residential	
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable	
Proposed development impermeable area (ha)	0.65	



Figure-1: Existing tidal flood zones and flood risk data

The site is wholly located within Flood Zone 3a with the Flood Map for Planning stating the risk is tidal. There is a FWA that covers the site in its entirety and the perimeter and south of the site is covered by two FAAs. The entire site is also within an ABD for the Wallasey Embankment.



FigureError! No text of specified style in document.-2: Topography

The elevation of the site does not vary greatly. The topography generally slopes upwards towards the centre of the site. The highest elevation of the site is approximately 5 mAOD near the centre with the lowest point approximately 4.6 mAOD at the site boundaries.

Flood Source: Tidal					
Flood Zones	Flood Zone 3b	Flood Zone 3b +climate change*	Flood Zone 3a	Flood Zone 3a +climate change*	Flood Zone 2
	0%	0%	100%	+0%	0%
Tidal: maximum depth	N/A	N/A	0.9 m	2.1 m	N/A
All figures stated based on undefended model					

*Climate change figures based on 70th percentile (higher central allowance)

RES-SA5.6: SHLAA 5146 Land at Twickenham Drive









RES-SA5.6: SHLAA 5146 Land at Twickenham Drive

RES-SA5.6: SHLAA 5146 Land at Twickenham Drive Tidal modelling: residual risk LIVINGSTONE Defence breach modelling on Wallasey embankment RES-SA5.6 Legend Site boundary 0.5% AEP +CC Depths 1.3 0.005 ☐ Metres 40 10 20 30 0 Contains Ordnance Survey data © Crown copyright and database right [2021] Figure 7: modelled Wallasey Embankment breach flood depths (m) for 0.5% AEP plus climate change event

RES-SA5.6: SHLAA	5146 Land at Twickenham Drive
	N Res-sa.s Eegend Site boundary 0.5% AEP + 02 ZUKb hazard rating Oranger for most Danger for most Danger for all 0 10 20 0 10 20
	Figure 8: modelled Wallasey Embankment breach flood hazards for 0.5% AEP plus climate change event
	The Wallasey Embankment breach modelling outputs show that there is significant residual risk to the site during the 0.5% AEP plus climate change event. Maximum depths within the site boundary reach 1.1 m and hazards across the majority of the site are 'danger for most'. The present -day Wallasey Embankment breach modelling does not impact the site. Although the modelling outputs show significant risk in the long term, the Shoreline Management Plan strategy on this section of coastline is to hold the line. Given the large area of Wirral at risk from such a breach of the Wallasey Embankment, it is
	unlikely that Wirral Council would cease funding for maintenance and defence improvements into the future.
Historic flooding	According to the EA's HFM, there is no known historic flooding within the vicinity of the site.
Defences	There are a number of flood walls and embankments to the south of the site along the banks of The Birket though it is thought they do not provide any protection to the site. The whole site lies within the EA's 'Areas Benefitting from Defences' polygon, protected by the Wallasey Embankment along the north coast of the Wirral.
2021s1045 Wirra	I Level 2 SFRA - Site RES-SA5.6 v2.0 9

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RES-SA5.6: SHLAA 5146 Land at Twickenham Drive		
Flood Warning Area	According to the EA's FW A dataset, there is a FWA for Irish Sea and Mersey Estuary from the Head of the Wirral to Runcorn that covers the entire site.	
Natural Flood Management / Working with Natural Process	According to the national scale 'potential for WwNP dataset', there is no potential for natural flood management within the immediate vicinity of the site.	
Observations, mitigation options & site	 The proposed use of the site would see a change in the risk classification from less vulnerable to more vulnerable, according to the NPPF. Given the change in use and therefore vulnerability of the site, the developer 	
suitability: tidal	will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the Framework's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development (Para 048 Flood Risk and Coastal Change PPG).	
	 The entirety of the site is located within tidal Flood Zone 3a according to the Flood Map for Planning, however the whole of the site is also within an ABD which protects the site against present day tidal flooding by way of the Wallasey Embankment. 	
	- In mapping ABDs, the EA assumes that flood defences and other operating structures act perfectly and give the same level of protection as when the previous assessment of the area was made. Consultation with the local council on the condition and maintenance arrangements of the Wallasey Embankment should be carried out however it would be expected, given the SMP policy of 'hold the line' that investment in the defences will continue in the long term.	
	- The impacts of climate change to this site are modelled to be significant.	
	 Residual risk of a breach of the Wallasey Embankment is modelled not to impact the site in the present day, however risk becomes significant with climate change. 	
	- Safe access and egress must be available during flood events. The Wirral Tidal 0.5% AEP event modelled outlines indicate safe access/egress to the site is not possible. However, the flood warning system in place should ensure site users can evacuate the site ahead of any present-day flood event in the short term.	
	 Given the modelled risk from climate change and the difficulties with access and egress routes, it is recommended this site should not be developed for residential use. Ideally, this site would remain for less vulnerable uses with appropriate resilience measures put in place or be cleared and used as a multifunctional greenspace for flood storage, amenity use and to provide environmental/ecological benefits. 	
	- Land raising may be an option given the risk is tidal therefore compensatory storage would not be required. It is likely that any land raising would be required to be above the 0.5% AEP +climate change event maximum level of 2.1m plus an additional 600mm freeboard. Access and egress routes would also have to be raised and must lead to flood free areas. With the scale of land raising required this option is likely to be unfeasible.	
	- Stilted development may be an option though is likely to be an expensive design solution with access and egress routes also required to be above the design flood level.	
	 A further option may be for ground floor parking or other less vulnerable uses (i.e. non-residential such as shops, restaurants, offices) and for habitable 	
2021s1045 Wirral	Level 2 SFRA - Site RES-SA5.6 v2.0	

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RES-SA5.6: SHLAA 5	146 Land at Twickenham Drive			
	dwellings to be situated on first floor and upwards. However, safe access and egress routes must be available at times of flood, even for above ground floor accommodation.			
Flood source: infrast	ructure failure – reservoirs (res	idual)		
Flood risk: reservoir	There is no risk of flooding t EA's online RFM.	to the site as a result of dam	failure, according to the	
Flood source: infrastr	ructure failure – canals (residua	I)		
Flood risk: canal	There are no canals in the vi	cinity of this site.		
Flood source: surface	e water			
Surface Water Flo	od Risk to Proposed Develo	opment Site		
Current site: Risk of Flooding from	High Risk (3.3% AEP event)	Medium Risk (1% AEP event)	Low Risk (0.1% AEP event)	
map	0%	0%	0%	
Surface water max flood depths	N/A	N/A	N/A	
Surface water flood risk to development site	Nominal risk			
Climate change	The current day 0.1% AEP event outline provides an indication of the likely increase in extent of the more frequent events. The site remains free from inundation during the 0.1% AEP event outline.			
Observations, mitigation options & site suitability: surface water	 A drainage strategy v surface water flood ri require consultation v 	vould be required to ensure t sk elsewhere as a result of n vith the LLFA.	there is no increase in new development. This will	
2021s1045 Wirral	Level 2 SFRA - Site RES-SA5.6 v2.0		11	



RES-SA5.6: SHLAA 5146 Land at Twickenham Drive

Surface Water Flood Risk from Proposed Development

Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for. For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 85% impermeable area and limiting greenfield runoff rate of Qbar (I/s).

Proposed development limiting runoff rate: (I/sec)

Obar: 2.4 I/s (assume 5 I/s minimum discharge) (FEH Statistical)

Q30: 4.08 l/s (assume 5 l/s minimum discharge)

Q100: 5 l/s

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volume m ³	Outflow volume m ³	Attenuation required m ³	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area	
30yr Rainfall+20%	6.5	382	82	300	23.7	0.020 ha 2.632 %	
30yr Rainfall+40%	7.75	463	98	365	28.9	0.024 ha 3.202 %	
100yr Rainfall+20%	7.75	533	98	435 (135 exceedance storage)	34.6	0.029 ha 3.816 %	
100yr Rainfall+40%	9	639	113	525 (160 exceedance storage)	41.6	0.035 ha 4.605 %	
Climate change	Application of the central (+20%) and upper end (+40%) allowances for potential change anticipated for the 2080s in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.						
Surface water: flood risk impacts from development site, mitigation & SuDS	As part of th land take if developmer Attenuation AEP event v developmer managed or	his Level 2 S a pond with t. volumes ar vith exceeda t worsening h site.	FRA we have an assumed e presented founce flows qua flood risk els	included calcula depth of 1.5m w or the critical sto antified up to the ewhere, surface	tions to provide vas included as orm duration for e 1% event. To water runoff m	e an estimated part of the the 3.33% prevent oust be	



RES-SA5.6: SHLAA 5	i146 Land at Twickenham Drive
Recommendation summary	 Based on the evidence presented in the Level 1 SFRA and this Level 2 SFRA: Early discussions should take place with the EA with regards to the tidal flood risk issues on this site. The EA offers early engagement through an advisory service via their website (https://www.gov.uk/guidance/developers-get-environmental-advice-on-your-planning-proposals) or by emailing the local office: SPPlanning.RFH@environment-agency.gov.uk. This site should not be developed for residential use. Ideally, this site would remain for less vulnerable uses with appropriate resilience measures put in place or be cleared and used as a multifunctional greenspace for flood storage, amenity use and to provide environmental/ecological benefits. Any consideration for development must fully investigate the options presented in this Level 2 SFRA, including for the provision of safe access and egress routes.
Can the second part of the Exception Test be satisfied?	No. To pass the Exception Test, it must be proven that the site can be safe for its lifetime, which for residential development is 100 years. The modelling in this Level 2 SFRA shows this will not be possible.
FRA requirements	 For development to proceed, the FRA must show the development can be safe for its lifetime and must not increase risk elsewhere. Any FRA should be carried out in line with the NPPF; FRCC-PPG; Local Plan and LLFA policies; and national and local SuDS policy and guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and the emergency services.
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Wirral Level 2 Strategic Flood Risk Assessment

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Site RES-SA5.8

Final Report

February 2022

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Revision History

Revision Ref/Date	Amendments	Issued to
V1.0 Draft September 2021	-	John Entwistle
V2.0 Draft December 2021	Council and EA comments addressed	John Entwistle
V2.0 Final February 2022	-	John Entwistle

Prepared by	Hannah Bishop BSc MSc
	Assistant Analyst
Reviewed by	Mike Williamson BSc MSc CGeog FRGS EADA
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Abbreviations

AOD	Above Ordnance Datum
BGS	British Geological Survey
EA	Environment Agency
FRCC-PPG	Flood Risk and Coastal Change Planning Practice Guidance
FMfP	Flood Map for Planning
FAA	Flood Alert Area
FRA	Flood Risk Assessment
FWA	Flood Warning Area
HFM	Historic Flood Map
LIDAR	Light Detection and Radar
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
RFM	Reservoir Flood Map
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
UU	United Utilities
WFD	Water Framework Directive



RES-SA5.8: Rear of 7	I to 5 Broster Close, Moreton	
Location	Broster Close, Moreton	
Site area (ha)	0.09	
Watercourse	Arrowe Brook	
EA Model used	Birket Fender and Arrowe Brook 2011	
Existing use	Storage yard	
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable	
Proposed use	Residential	
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable	
Proposed development impermeable area (ha)	0.08	


Figure 1: Existing fluvial flood zones and flood risk data

The Main River Arrowe Brook flows northwards just to the east of the site where it is culverted for approximately 50 m underneath where the industrial building to the immediate east of the site connects to Bermuda Road. There is an unknown drain running along the southern boundary of the site. The site has a small area within Flood Zone 2 in the south of the boundary with the rest of the site being within Flood Zone 1. The site is partially within a FWA and a FAA.



Figure 2: Topography

The elevation of the whole site does not vary substantially remaining at approximately 7.5 mAOD which is consistent with the surrounding area. The elevation of Arrowe Brook to the north east of the site is lower at approximately 5 mAOD.

Flood Source: Fluvial						
Flood Zones	Flood Zone 3b	Flood Zone 3b +climate change*	Flood Zone 3a	Flood Zone 3a +climate change*	Flood Zone 2	
	0%	0%	0%	0%	4%	
Fluvial: maximum depth	N/A	N/A	N/A	N/A	0.1 m	

RES-SA5.8: Rear of 1 to 5 Broster Close, Moreton

Flood Zone 3b figures stated based on defended model; Flood Zone 3a and 2 figures stated based on undefended model

*Climate change figures based on central allowance (+44% on peak flows)



¹ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291126/scho0509bqat-e-e.pdf

RES-SA5.8: Rear of	1 to 5 Broster Close, Moreton		
Flood Warning Area	According to the EA's FWA dataset, there are two FWAs in operation. One in the south for the Irish Sea and Mersey Estuary from the Head of the Wirral to Runcorn affecting areas of Hoylake, Meols, Moreton and Wallasey. The other FWA covers a very small area in the north for Arrowe Brook at Moreton West.		
Natural Flood Management / Working with Natural Process	The site lies outside the national scale 'potential for WwNP dataset'.		
Observations, mitigation options & site suitability: fluvial	 The proposed use of development would see a change in risk classification from less vulnerable to more vulnerable according to the NPPF. Given the change in use and therefore vulnerability of the site, the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the Framework's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development (Para 048 Flood Risk and Coastal Change PPG). The ditch on the southern boundary will need assessing and any risk quantifying. The site is only partially within Flood Zone 2 in the south with the rest of the site being located within Flood Zone 1. More vulnerable development would be appropriate across the entire site, and thus residential yields should not be impacted. The site remains free from additional risk from climate change for the 1% AEP event as the risk remains centred around Arrowe Brook. A capacity and condition survey may be required for the culvert on Arrowe Brook as it may cause residual risk to the site if it becomes blocked. Safe access and egress should be possible via Broster Avenue as it is wholly 		
Flood source: infras	tructure failure – reservoirs (res	idual)	
Flood risk: reservoir	There is no risk of flooding EA's online RFM.	to the site as a result of dam	n failure, according to the
Flood source: infrast	ructure failure – canals (residua	l)	
Flood risk: canal	There are no canals in the v	icinity of the site.	
Flood source: surfac	e water		
Surface Water Flo	ood Risk to Proposed Devel	opment Site	
Current site: Risk of Flooding from Surface Water	High Risk (3.3% AEP event)	Medium Risk (1% AEP event)	Low Risk (0.1% AEP event)
map	2.0%	15.2%	99.2%
Surface water max flood depths	0.15 – 0.3 m	0.15 – 0.3 m	0.3 – 0.6 m





Figure 5: 1% AEP event surface water flood hazards (Risk of Flooding from Surface Water map)

* Surface water hazard rating based on Table 4.2 Hazard to People as a Function of Velocity and Depth, R&D OUTPUTS: FLOOD RISKS TO PEOPLE: PHASE 2 FD2321/TR2. Defra. March 2006.

Surface water flood risk to development site	Approximately 15% of the site is at risk of surface water flooding in the 1% AEP event to a maximum depth of between 0.15 and 0.3 m with areas of low hazard. The risk is primarily localised to the south of the site.
	However, safe access and egress may prove challenging as the land around the site is at risk. Broster Avenue is inundated during the 1% AEP event to a maximum depth of between 0.3 and 0.6 m with a moderate hazard rating.





RES-SA5.8: Rear of	1 to 5 Broster Cl	ose, Moreto	on			
	access - Judgin blocka culver - The si appea 600m - Full co be allo	and egres g from the ge of the r t is require te may be rs that any m. nsultation ocated.	es routes at all mapping, the nearby culvert o d. too small to act access and eg with the LLFA w	times. increased risk m on Arrowe Brook hieve effective r ress routes wou will be required	hay, in part, be c. Further inve nitigation onsi Id have to be r on this site we	e due to estigation of the te and it raised above re this site to
Surface Water Flo	ood Risk from	Proposed	d Developmen	t		
Runoff rates should aimed for. For the calculated below ba (I/s).	I not exceed cu purposes of thi ased on an assu	rrent rates s assessm imed 85%	and if possible ent, the require impermeable a	, betterment of ed volumes of at rea and limiting	existing rates tenuation have greenfield rur	should be e been noff rate of Qbar
Proposed developm Obar: 0.47 l/s (assu Q30: 0.79 l/s (assu Q100: 0.97 l/s (ass	ent limiting run ume 5 l/s minin me 5 l/s minim ume 5 l/s minir	off rate: (I num discha um dischai num discha	/sec) arge) (FEH Stat rge) arge)	istical)		
Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volum e m ³	Outflow volume m ³	Attenuation required m ³	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	0.75	27	9	18	1.4	0.001 ha 1.333 %
30yr Rainfall+40%	0.75	32	9	22	1.8	0.001 ha 1.630 %
100yr Rainfall+20%	1	41	13	28 (10 exceedance storage)	2.2	0.002 ha 2.074 %
100yr Rainfall+40%	1	48	13	35 (13 exceedance storage)	2.8	0.002 ha 2.593 %
Climate change	Application o change antic attenuation v	f the centr ipated for volumes fo	al (+20%) and the 2080s in th r the 1% AEP a	upper end (+40 e table above sh nd 3.33% AEP r	0%) allowance nows the estim rainfall events.	s for potential nated
Surface water: flood risk impacts from development site, mitigation & SuDS	As part of thi land take if a development Attenuation AEP event wi development managed on	s Level 2 S pond with volumes ar th exceeda worsening site.	SFRA we have i an assumed d re presented for ance flows quar g flood risk else	ncluded calculat epth of 1.5m wa the critical stor ntified up to the where, surface	ions to provide as included as m duration for 1% event. To water runoff m	e an estimated part of the the 3.33% prevent oust be





RES-SA5.8: Rear of 1	to 5 Broster Close, Moreton
	access and egress routes.
Can the second part of the Exception Test be satisfied?	Site not subject to the Exception Test though development may be permitted assuming it can be shown that surface water risk can be mitigated effectively onsite and included within the site design. If not, development of this site should not be permitted.
FRA requirements	 The FRA should include a detailed drainage strategy for the proposed new development layout including more detailed surface water modelling. Full consultation with the LLFA will be required. Condition and inspection surveys of the culvert should be carried out. Quantify risk, if any, from the unnamed ditch. The drainage strategy should include emergency planning procedures and ensuring safe access and egress routes in times of flood. Any FRA should be carried out in line with the NPPF; FRCC-PPG; Local Plan and LLFA policies; and national and local SuDS policy and guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and the emergency services.
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Wirral Level 2 Strategic Flood Risk Assessment

JBA

Site RES-SA5.9

Final Report

February 2022

www.jbaconsulting.com



JBA Project Manager

Mike Williamson JBA Consulting Second Floor Phoenix House Lakeside Drive Centre Park Warrington WA1 1RX

Revision History

Revision Ref/Date	Amendments	Issued to
V1.0 Draft	-	John Entwistle
September 2021		
V1.0 Final February	-	John Entwistle
2022		

Prepared by	Hannah Bishop BSc MSc
	Assistant Analyst
Reviewed by	Mike Williamson BSc MSc CGeog FRGS EADA
	Principal Flood Risk Analyst

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Abbreviations

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LPA	Local Planning Authority
NPPF	National Planning Policy Framework
RFM	Reservoir Flood Map
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
UU	United Utilities
WFD	Water Framework Directive

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S	

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According to the Environment Agency's flood risk datasets, there is no known fluvial or tidal flood risk to the site. The site is wholly within Flood Zone 1.



Figure 2: Topography

The elevation of the whole site does not vary substantially remaining at approximately 35 mAOD where it gradually declines towards the north east surrounding area which has a lower elevation of around 31 mAOD.

Historic flooding	According to the EA's Historic Flood Map, there are no known flooding events that have occurred within the vicinity of the site.
Defences	There is no known flood defence infrastructure in the vicinity of the site.
Flood Warning Area	According to the EA's FWA dataset, there are no known Flood Warning Areas within the vicinity of the site.
Natural Flood Management / Working with	There are no opportunities for Natural Flood Management within the vicinity of the site.

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RES-SA5.9: Former A	Arrowe Hill Primary School, Woo	odchurch		
Natural Process				
Observations, mitigation options & site suitability: fluvial/tidal	 The site falls within Flood Zone 1, with no observed fluvial or tidal flood risk, indicating very low fluvial and tidal flood risk to the site. Safe access and egress appear to be available via Woodland Road or Atherton Drive. 			
Flood source: infrast	ructure failure – reservoirs (res	idual)		
Flood risk: reservoir	There is no risk of flooding to the site as a result of dam failure, according to the EA's online RFM.			
Flood source: infrast	ructure failure – canals (residua	I)		
Flood risk: canal	There are no canals in the vicinity of the site.			
Flood source: surface	e water			
Surface Water Flo	od Risk to Proposed Develo	opment Site		
Current site: Risk of Flooding from Surface Water map	High Risk (3.3% AEP event)	Medium Risk (1% AEP event)	Low Risk (0.1% AEP event)	
	5.2%	15.1%	28.3%	
Surface water max flood depths	0.15 – 0.3 m	0.3 - 0.6 m	0.3 - 0.6 m	





Surface Water map)

*Surface water hazard rating based on Table 4.2 Hazard to People as a Function of Velocity and Depth, R&D OUTPUTS: FLOOD RISKS TO PEOPLE: PHASE 2 FD2321/TR2. Defra. March 2006.

Surface water flood risk to development site	Approximately 15% of the site is at risk of surface water flooding in the 1% AEP event to a maximum depth of between 0.3 and 0.6 m with areas of low and moderate hazard rating. The risk is primarily localised to the south west and north west of the site. In the north west of the site, the risk is localised and constrained by the existing building.
	Safe access and egress may be possible via Woodland Road though it is shown to flood during the 1% AEP event to a maximum depth of between 0.3 and 0.6 m with a moderate hazard rating. Atherton Drive to the north west of the site may be viable for safe access and egress as it remains partially free from inundation during
	Viable for sale access and egress as it remains partially nee from mundation during



RES-SA5.9: Former A	Arrowe Hill Primary School, Woodchurch
Observations, mitigation options & site suitability: surface water	 The flow path from Woodland Road will need investigating initially through more detailed surface water modelling and ground investigation including inspections of gullies and the drainage network. It is expected the current school buildings will be demolished for new residential development which will alter the surface water flow routes. Surface water modelling should be carried out post site clearance and pre-development to ascertain topographic flow paths. Rezoning and regrading of the land to divert and store surface water to suit the new development should be modelled and included in site design. All surface water should be attenuated onsite. Assessment of the current drainage system in place should be carried out to ascertain any current capacity issues and whether the current system could accommodate the proposed residential development or whether further capacity will be required. A drainage strategy, including surface water modelling, will be required to ensure there is no increase in surface water flood risk elsewhere as a result of new development.

Surface Water Flood Risk from Proposed Development

Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for. For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 85% impermeable area and limiting greenfield runoff rate of Qbar (I/s).

Proposed development limiting runoff rate: (I/sec)

Qbar: 1.36 l/s (assume 5 l/s minimum discharge) (FEH Statistical)

Q30: 2.31 I/s (assume 5 I/s minimum discharge)

Q100: 2.83 l/s (assume 5 l/s minimum discharge)

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volum e m ³	Outflow volume m³	Attenuation required m ³	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	2.75	132	35	97	7.7	0.006 ha 2.021 %
30yr Rainfall+40%	3	157	38	119	9.4	0.008 ha 2.479 %
100yr Rainfall+20%	3.5	190	44	146 (49 exceedance storage)	11.5	0.010 ha 3.042 %
100yr Rainfall+40%	4	228	50	178 (59 exceedance storage)	14.1	0.012 ha 3.708 %
Climate change	Application of the central (+20%) and upper end (+40%) allowances for potential change anticipated for the 2080s in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.					

RES-SA5.9: Former Arrowe Hill Primary School, Woodchurch

Surface water: flood risk impacts from	As part of this Level 2 SFRA we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development.
development site, mitigation & SuDS	Attenuation volumes are presented for the critical storm duration for the 3.33% AEP event with exceedance flows quantified up to the 1% event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.

Flood Source: Groundwater

Flood risk: groundwater



cannot be used on its own to indicate risk of groundwater flooding. The dataset shows that the site is not prone to groundwater flooding.



RES-SA5.9: Former Arrowe Hill Primary School, Woodchurch				
Overall Site Assessn	nent			
Access and egress	Safe access and egress may be possible via Woodland Road though it is shown to flood during the 1% AEP event to a maximum depth of between 0.3 and 0.6 m with a moderate hazard rating. Atherton Drive to the north west of the site may be viable for safe access and egress as it remains partially free from inundation during the 1% AEP event, however the existing residential properties may restrict any access routes.			
Recommendation summary	 Based on the evidence presented in the Level 1 SFRA and this Level 2 SFRA: A full drainage strategy should be carried out, including modelling of flow routes, mitigation options and source control. Investigation into appropriate SuDS options should be explored. Early consultation with the LLFA should be carried out regarding surface water flood risk control and mitigation onsite. Emergency planning for the site should consider appropriate access and egress routes. 			
Can the second part of the Exception Test be satisfied?	Site not subject to the Exception Test though development may be permitted assuming it can be shown that surface water risk can be mitigated effectively onsite and included within the site design. If not, development of this site should not be permitted.			
FRA requirements	 A drainage strategy should be produced in consultation with the LLFA. Any site-specific work should be carried out in line with the NPPF; FRCC-PPG; Local Plan and LLFA policies; and national and local SuDS policy and guidelines. Consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and the emergency services. 			
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Wirral Level 2 Strategic Flood Risk Assessment

JBA

Site RES-SA6.12

Final Report

February 2022

www.jbaconsulting.com



JBA Project Manager

Mike Williamson JBA Consulting Second Floor Phoenix House Lakeside Drive Centre Park Warrington WA1 1RX

Revision History

Revision Ref/Date	Amendments	Issued to
V1.0 Draft September 2021	-	John Entwistle
V2.0 Draft December 2021	Council and EA comments addressed	John Entwistle
V2.0 Final February 2022	-	John Entwistle

Prepared by	Laura Thompson BSc
	Assistant Analyst
Reviewed by	Mike Williamson BSc MSc CGeog FRGS EADA
	Principal Flood Risk Analyst

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SFRA	Strategic Flood Risk Assessment
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UU	United Utilities
WFD	Water Framework Directive

RES-SA6.12: SHLAA	5055 Beauty Within, 206 Birkenhead Road
Location	Meols, Wirral
Site area (ha)	0.07
Watercourse	Coastal
EA Model used	Wirral Tidal 2015
Existing use	Commercial premises
Existing site flood risk vulnerability classification (NPPF)	Less vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification (NPPF)	More vulnerable
Proposed development impermeable area (ha)	0.06

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RES-SA6.12: SHLAA 5055 Beauty Within, 206 Birkenhead Road

Figure 1: Existing tidal flood zones and flood risk data

The entirety of the site falls within tidal Flood Zone 3a. The whole site lies within the EA's 'Areas Benefitting from Defences' polygon, which shows the areas protected against tidal flooding by the Wallasey Embankment.



Figure 2: Topography

The elevation varies slightly across the site. **There's an area of high ground through the centre of the site** at approximately 6 mAOD. The topography slopes down towards the north, with an elevation of approximately 5 mAOD, and to the south, with an elevation of approximately 4 mAOD.

Flood Source: Tidal					
Flood Zones	Flood Zone 3b	Flood Zone 3b +climate change*	Flood Zone 3a	Flood Zone 3a +climate change*	Flood Zone 2
	0%	+0%	100%	+0%	0%
Tidal: maximum depth	N/A	N/A	1.45 m	2.46 m	N/A
All figures stated ba	ased on undefende aures based on 70 ^t	ed model ^{ih} percentile (high	er central allowar	nce)	

RES-SA6.12: SHLAA 5055 Beauty Within, 206 Birkenhead Road Modelled tidal risk including climate change (Wirral Tidal 2015 model) NOTE: modelled outputs for this SFRA are subtly different to original 2015 modelled outputs due to upgraded modelling and GIS software RES-SA6.12 Legend Site boundary 0.5% AEP Depths 1.5 0.003 → Metres 40 10 20 30 0 Contains Ordnance Survey data © Crown copyright and database right [2021] Figure 3: modelled tidal flood depths (m) for 0.5% AEP baseline event







RES-SA6.12: SHLAA 5055 Beauty Within, 206 Birkenhead Road




RES-SA6.12: SHLAA 5055 Beauty Within, 206 Birkenhead Road					
Natural Process	through woodland planting, and also areas that have been identified as having the potential to attenuate flooding during high flows.				
Observations, mitigation options & site suitability: tidal	 The proposed use of the site would see a change in the risk classification from less vulnerable to more vulnerable, according to the NPPF. The site appears to currently be a former shop. It is not known at this stage whether the proposed change in use will entail the conversion of the existing building into a dwelling within the same development footprint, or whether new development is planned. Given the change in use and therefore vulnerability of the site, the developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the change of use meets the objectives of the Framework's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development (Para 048 Flood Risk and Coastal Change PPG). The entirety of the site is located within tidally influenced Flood Zone 3a according to the Flood Map for Planning. This is backed up by the modelling. However, the whole of the site is within an ABD which protects the site against present day tidal flooding by way of the Wallasey Embankment. There is however no flood warning in place for the site. In mapping ABDs, the EA assumes that flood defences and other operating structures act perfectly and give the same level of protection as when the previous assessment of the area was made. Consultation with the local council on the condition and maintenance arrangements of the Wallasey Embankment should be carried out however its would be expected, given the SMP policy of 'hold the line' that investment in the defences will continue in the long term. Residual risk of a breach of the Wallasey Embankment is modelled not to impact the site in the present day, however risk becomes significant with climate change. The impacts of climate change to this site are modelled to be significant from tidal sources.<				
Flood source: infrast	tructure failure – reservoirs (residual)				
Flood risk: reservoir	There is no risk of flooding to the site as a result of dam failure, according to the EA's online RFM.				
Flood source: infrast	ructure failure – canals (residual)				
Flood risk: canal	There are no canals in the vicinity of this site.				

RES-SA6.12: SHLAA 5055 Beauty Within, 206 Birkenhead Road Flood source: surface water Surface Water Flood Risk to Proposed Development Site Current site: Risk High Risk Medium Risk Low Risk of Flooding from (3.3% AEP event) (1% AEP event) (0.1% AEP event) Surface Water 19.3% 74.7% 50.5% map Surface water 0.3 **-** 0.6 m 0.3 – 0.6 m 0.6 – 0.9 m max flood depths



Figure 9: 1% AEP event surface water flood depths (Risk of Flooding from Surface Water map)



RES-SA6.12: SHLAA 5055 Beauty Within, 206 Birkenhead Road

Figure 10: 1% AEP event surface water flood hazards (Risk of Flooding from Surface Water map)

*Surface water hazard rating based on Table 4.2 Hazard to People as a Function of Velocity and Dept	h,
R&D OUTPUTS: FLOOD RISKS TO PEOPLE: PHASE 2 FD2321/TR2. Defra. March 2006.	

Surface water flood risk to development site	Approximately half of the site is at risk of surface water flooding in the 1% AEP event to a maximum depth of between 0.3 and 0.6 m, with areas of moderate and significant hazard. The risk is likely constrained by current development.
Climate change	The current day 0.1% AEP event outline provides an indication of the likely increase in extent of the more frequent events. The 0.1% AEP event outline covers almost 75% of the total site which is again constrained by current development. Birkenhead Road to the north become partially inundated, with depths of 0.3 – 0.6 m, meaning safe access/egress may not be viable during a 0.1% AEP flood event or in the long term.





JRA

RES-SA6.12: SHLAA 5055 Beauty Within, 206 Birkenhead Road

Surface Water Flood Risk from Proposed Development

Runoff rates should not exceed current rates and if possible, betterment of existing rates should be aimed for. For the purposes of this assessment, the required volumes of attenuation have been calculated below based on an assumed 85% impermeable area and limiting greenfield runoff rate of Qbar (I/s).

Proposed development limiting runoff rate: (l/sec)

Qbar: 0.13 I/s (FEH Statistical)

Q30: 0.22 l/s

Q100: 0.27 l/s

Design flood event (incl climate change)	Critical storm duration Hrs	Inflow volum e m ³	Outflow volume m ³	Attenuation required m ³	Time to empty (assuming no infiltration) Hrs	Total storage required: Area (ha) and % of site area
30yr Rainfall+20%	0.5	18	6	12	0.9	0.001 ha 1.143 %
30yr Rainfall+40%	0.5	21	6	15	1.2	0.001 ha 1.429 %
100yr Rainfall+20%	0.75	28	9	19 (7 exceedanc e storage)	1.5	0.001 ha 1.810 %
100yr Rainfall+40%	1	36	13	23 (8 exceedanc e storage)	1.9	0.002 ha 2.190 %
Climate change	Application of the central (+20%) and upper end (+40%) allowances for potential change anticipated for the 2080s in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.					
Surface water: flood risk impacts from development site, mitigation & SuDS	As part of this Level 2 SFRA we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development. Attenuation volumes are presented for the critical storm duration for the 3.33% AEP event with exceedance flows quantified up to the 1% event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.					



RES-SA6.12: SHLAA	5055 Beauty Within, 206 Birkenhead Road				
Recommendation summary	 Based on the evidence presented in the Level 1 SFRA and this Level 2 SFRA: Early discussions should take place with the EA with regards to tidal flood risk issues on this site. The EA offers early engagement through an advisory service via their website (https://www.gov.uk/guidance/developers-get-environmental-advice-on-your-planning-proposals) or by emailing the local office: SPPlanning.RFH@environment-agency.gov.uk. This site should not be redeveloped for residential use. This site should remain for less vulnerable uses with appropriate resilience measures put in place. Any consideration for development must fully investigate the options presented in this Level 2 SFRA, including for the provision of safe access and egress routes. 				
Can the second part of the Exception Test be satisfied?	No. To pass the Exception Test, it must be proven that the site can be safe for its lifetime, which for residential development is 100 years. The modelling in this Level 2 SFRA shows this will not be possible.				
FRA requirements	 For development to proceed, the FRA must show the development can be safe for its lifetime and must not increase risk elsewhere. Any FRA should be carried out in line with the NPPF; FRCC-PPG; Local Plan and LLFA policies; and national and local SuDS policy and guidelines. Throughout the FRA process, consultation should be carried out with the following, where applicable, the LPA; LLFA; emergency planning officers; EA; UU; the highways authorities; and the emergency services. 				
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