

FLOOD RISK ASSESSMENT REPORT/DRAINAGE STRATEGY

SITE

New Cash and Carry Units
Bradstone Road
Whalley Range
Manchester

CLIENT

Supreme Developments

REFERENCE

21-3050/SWH

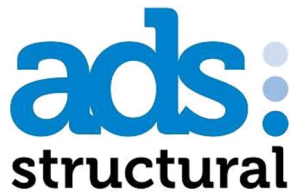
PREPARED BY

ADS Structural Limited

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ADS Structural Limited Ltd was commissioned to provide consultancy services in connection with the proposed development of land at the above-mentioned address. The proposed development is to convert and redevelop the existing industrial site into three number commercial units and associated infrastructure.

This is a Flood Risk Assessment Report undertaken to identify potential risks associated with flooding and to demonstrate to the Local Planning Authority and Environment Agency (EA) that the proposals outlined above can be satisfactorily accommodated without worsening flood risk for the area, in accordance with the National Planning Policy Framework Document (NPPF).

The Local Planning Authority has advised the client that this document should be produced in order to confirm the flood risk status of the development site.

The following documents have been reviewed as part of this assessment:

- National Planning Policy Framework (NPPF) (March 2012)
- Technical Guidance to the NPPF (March 2012)

The planning process requires an assessment of any flood risks related to the proposed development and in particular two key issues:

- Whether the development itself would be at risk of being flooded.
- Whether the development would increase the risk of flooding elsewhere.

Liaison with the Environment Agency was undertaken to determine the occurrences of flooding in the area.

The report will also look at a surface water drainage strategy for the proposed development to establish constraints and design requirements and to promote the use of Sustainable Drainage Systems (SuDS) as per the requirements set out in the NPPF.

2.0 SITE DESCRIPTION

2.1. Site Location

The National Grid Reference for the approximate site centre is 383987,400073 and it is located on Bradstone Road, Cheetham Hill, Manchester.

The site measures 3521m² in area.

The existing site is currently occupied by the remnants of a previously demolished building and infrastructure.

The development has no significant gradients around the site.

2.2. Existing Watercourses & Drainage Features

The nearest available watercourse is noted as a small pond to the north of the site although it should be noted that a large slurry lagoon is present on the northeast corner of the site.

2.3. Existing Drainage / Sewers

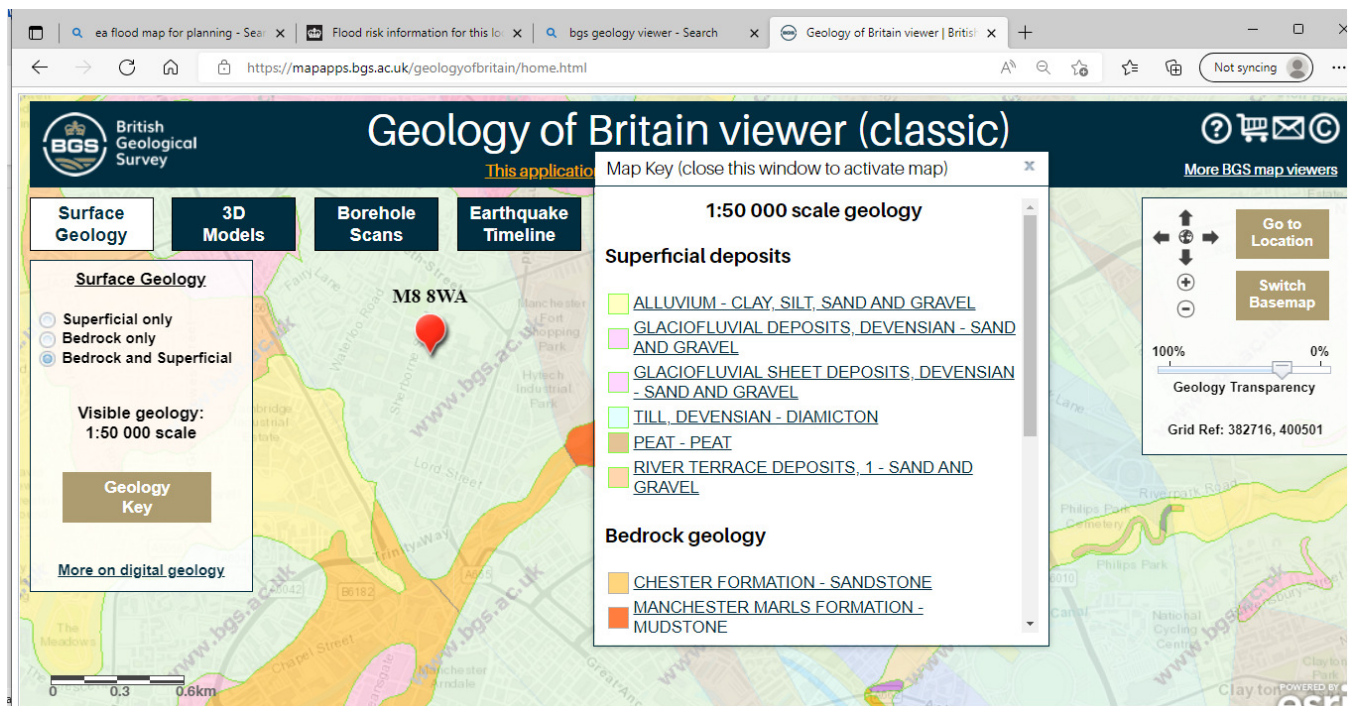
It is believed that there is a large diameter combined sewer in Bradstone Road

2.4. Proposed Development

A new development to include for the redevelopment of the site to allow for the creation of three new commercial storage facility buildings.

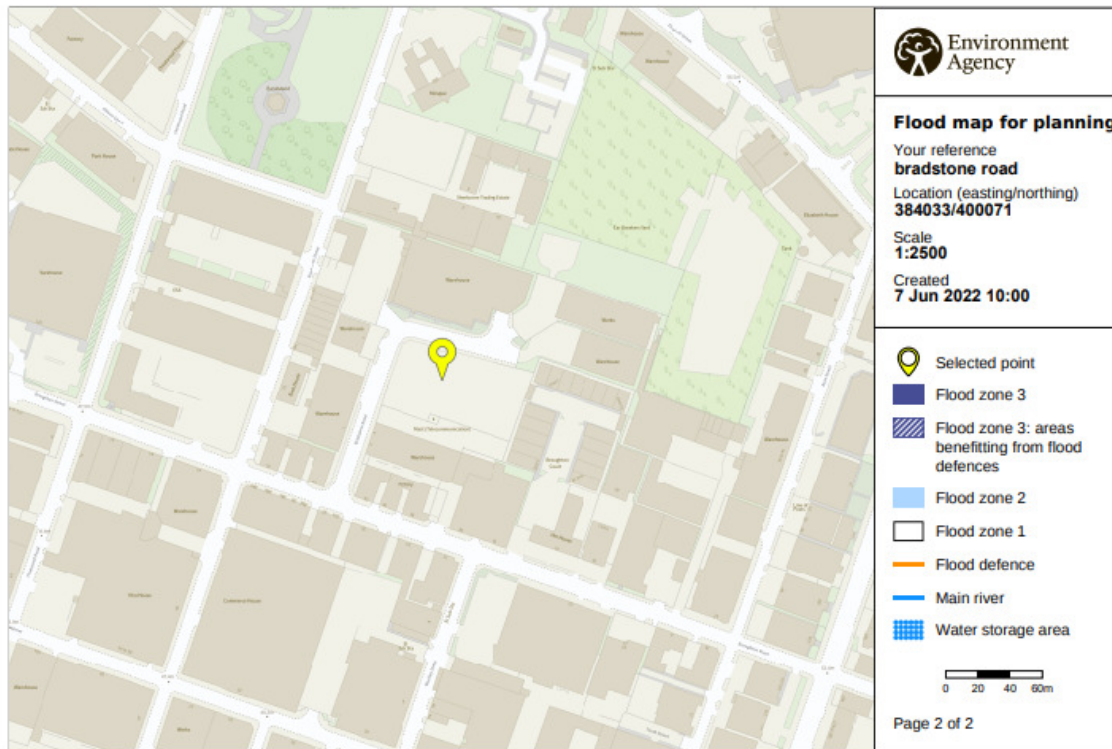
2.5. Ground Conditions

Ground investigations in the form historic BGS borehole logs reveal that the site is underlain with devensian till (see below) and thus infiltration drainage would not be feasible.



3.0 SITE FLOODING POTENTIAL

3.1 Environment Agency information.



The Environment Agency map indicates that the site is with flood Zone1, a site falling within Flood Zone 1 is defined by PPS25 as having a low probability of flooding.

- Flood Zone 1 - land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).
- **Flood Zone 2 - land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.**
- Flood Zone 3 - land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

4.0 FLOOD RISK AND VULNERABILITY

The NPPF sets out the flood risk for a site by assessing the flood zones, flood risk vulnerability classification, and flood risk vulnerability and flood zone 'compatibility'.

Flood risk takes account of both the probability and the consequences of flooding (i.e. vulnerability of the development etc.). Flood frequency is usually interpreted in terms of the return period e.g. 1 in 50 and 1 in 100-year event etc. In betting terms, there is a 50/1 (2%) chance of one or more 1 in 50-year floods occurring in a given year. Similarly, there is a 100/1 (1%) chance of one or more 1 in 100-year floods occurring in a given year.

4.1 Flood Zones

(These Flood Zones refer to the probability of river and sea flooding, ignoring defences)

Zone 2 Medium Probability

Definition

This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1%) in any year.

Appropriate uses

The water-compatible, less vulnerable and more vulnerable uses of land and essential infrastructure in Table D.2 are appropriate in this zone. Subject to the Sequential Test being applied, the highly vulnerable uses in Table D.2 are only appropriate in this zone if the Exception Test (see para. D.9.) is passed.

FRA requirements

All development proposals in this zone should be accompanied by a FRA. See Annex E for minimum requirements.

Policy aims

In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage techniques.

4.2 Flood Risk Vulnerability Classification

In accordance with Technical Guidance to the NPPF Table 2: Flood Risk Vulnerability Classification, the proposed site usage is classified as '**less vulnerable**'.

Essential Infrastructure	<ul style="list-style-type: none"> Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk, and strategic utility infrastructure, including electricity generating power stations and grid and primary substations.
Highly Vulnerable	<ul style="list-style-type: none"> Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications installations required to be operational during flooding. Emergency dispersal points. Basement dwellings. Caravans, mobile homes and park homes intended for permanent residential use. Installations requiring hazardous substances consent.
More Vulnerable	<ul style="list-style-type: none"> Hospitals. Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels. Non-residential uses for health services, nurseries and educational establishments. Landfill and sites used for waste management facilities for hazardous waste. Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	<ul style="list-style-type: none"> Buildings used for: shops; financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non-residential institutions not included in 'more vulnerable'; and assembly and leisure. Land and buildings used for agriculture and forestry. Waste treatment (except landfill and hazardous waste facilities). Minerals working and processing (except for sand and gravel working). Water treatment plants. Sewage treatment plants (if adequate pollution control measures are in place).
Water-compatible Development	<ul style="list-style-type: none"> Flood control infrastructure. Water transmission infrastructure and pumping stations. Sewage transmission infrastructure and pumping stations. Sand and gravel workings. Docks, marinas and wharves. Navigation facilities. MOD defence installations. Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. Water-based recreation (excluding sleeping accommodation). Lifeguard and coastguard stations. Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

Notes:

1) This classification is based partly on Defra/Environment Agency research on Flood Risks to People (FD2321/TR2)21 and also on the need of some uses to keep functioning during flooding.

2) Buildings that combine a mixture of uses should be placed into the higher of the relevant classes of flood risk sensitivity. Developments that allow uses to be distributed over the site may fall within several classes of flood risk sensitivity.

3) The impact of a flood on the particular uses identified within this flood risk vulnerability classification will vary within each vulnerability class. Therefore, the flood risk management infrastructure and other risk mitigation measures needed to ensure the development is safe may differ between uses within a particular vulnerability classification.

Flood Risk Vulnerability classification (see Table D2)		Essential Infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1					
	Zone 2			Exception Test required		
	Zone 3a	<u>Exception Test required</u>		X	Exception Test required	
	Zone 3b 'Functional Floodplain'	Exception Test required		X	X	X

ed appropriate for development based on the flood zone to which the site lies, and the flood risk vulnerability classification.

Key:

Development is appropriate.

X Development should not be permitted.

5.0 FLOOD SOURCE ASSESSMENT

In accordance with the NPPF, flood risk must be assessed for all sources of flooding and development of the site should be carried out in such a way as to mitigate any potential flood risk to both the site and third parties and their property. The possible sources of flooding include:

- Fluvial Flooding
- Pluvial Flooding
- Groundwater Flooding
- Flooding from Drains and Sewers
- Canals, Reservoirs and Other Artificial Sources
- Climate change

5.1 Fluvial Flooding

Fluvial flooding is resulted from watercourses / rivers surcharging and flooding the surrounding areas. The site could be affected by fluctuations in the level of the pond

5.2 Pluvial Flooding

'Pluvial' flooding is that which results from rainfall generated overland flow before the run-off enters any watercourse, drain or sewer. Hardstanding both existing and proposed can result in overland flows.

5.3 Groundwater Flooding

Groundwater flooding is caused by the emergence of water from sub-surface permeable strata caused by fluctuations in the groundwater table. Given the proximity of the adjacent open drain fluctuations in the ground water table is unlikely.

5.4 Flooding from Drains and Sewers

Flooding from drains and sewers is caused when the capacity of the drains and sewers is exceeded. Older drains are unlikely to have been designed to cater for severe storm conditions.

5.5 Canals, Reservoirs and Other Artificial Sources

Flooding from canals, reservoirs and artificial sources is caused when the capacity of the sources are exceeded, or if there is an infrastructure failure. The site is unlikely to be affected by fluctuations in the level of the adjacent drain.

5.6 Climate Change

The NPPF makes it a planning requirement to account for climate change in the proposed design. The recommended allowances are summarised in the tables below.

Sea Levels

Administrative Region	Net Sea Level Rise (mm/yr) Relative to 1990			
	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
East of England, East Midlands, London, SE England (south of Flamborough Head)	4.0	8.5	12.0	15.0
South West	3.5	8.0	11.5	14.5
NW England, NE England (north of Flamborough Head)	2.5	7.0	10.0	13.0

Rainfall & Rivers

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak rainfall intensity	+5%	+10%	+20%	+30%
Peak river flow	+10%	+20%		
Offshore wind speed	+5%		+10%	
Extreme wave height	+5%		+10%	

The baseline year is 1961 to 1990.

It is anticipated the life span of the structure will be approximately 60 years, and therefore will fall at least into the 2070's.

6.0 FLOODING ASSESSMENT

Refer to Appendix A for Envirocheck flood map data. The data shown on the maps have been sourced by studies from the Environment Agency (EA). The summary of each of the maps are as follows:

6.1 Fluvial Flooding

Upon inspection of the available data it appears that flooding does not occur on the site

6.2 Pluvial Flooding

Upon inspection of the available data it appears that the site is not affected.

6.3 Groundwater Flooding

The site water table is well below ground level. Given the maximum increase in flood level of the adjacent drain ground water flooding is not considered likely.

6.4 Flooding from Drains and Sewers

Upon inspection of the available data surface water flooding is not likely even in the 1 in 100 year event.

However, without suitably designed drainage severe storm conditions, either intense short durations or less intense longer durations are likely to see overland flows generated. The building on site adjacent to the proposed development appears relatively new. The drainage system and hardstanding levels may have duly considered significant rainfall intensities and been designed to prevent flooding. The existing site use consists impermeable areas. This results in the following surface water runoff assessment of existing and proposed discharge from the site:

Storm Event Frequency (15min event)	Existing site Discharge rate (L/s)	Proposed Site Discharge rate (L/s)
1 in 1 year	10.8	10.6
1 in 30 years	26.2	11.4
1 in 100 year +40%	34.3	15.5

To ensure no flooding occurs the proposed site drainage system should be designed not to exceed a flow rate of 50litres per second which equates to a reduction of 50% of the original flow (See Micro Drain calculations)

This Flood Risk Assessment Report should be read in conjunction with the Drainage Strategy document.

6.5 Canals, Reservoirs and Other Artificial Sources

Refer to Item 6.1 above.

6.6 Climate Change

Any proposed drainage system should be designed to cater for climate change. If appropriately designed then flooding both onsite and offsite is unlikely to occur.

7.0 Design Philosophy

Drainage is to be designed and constructed in accordance with the National Planning Policy Framework and Planning Practice Guidance. A sustainable drainage system is to be designed for this site on affordance with DEFRA Non-statutory technical standards for sustainable drainage systems – March 2015.

A sustainable drainage system (SuDS) is designed to replicate, as closely as possible, the natural drainage from the Site (before development) to ensure that the flood risk downstream of the site does not increase as a result of the land being developed. SuDS can also significantly improve the quality of water leaving the site and can enhance the amenity and biodiversity that a site has to offer. There are a range of SuDS options available to provide effective surface water management that intercept and store excess run-off. When considering these options, the destination of the runoff should be considered using the order of preference outlined DEFRA's National Standards for SuDS as follows:

1. Discharge to the ground
2. Discharge to a surface water body
3. Discharge to a surface water sewer
4. Discharge to a local highway drain
5. Discharge to a combined sewer

Possible receptors for run-off generated onsite have been assessed in line with the prioritisation set onsite out in the Draft National Standards (Defra, 2015).

SuDS Group	Suitability	Assessment
Discharge to the ground	NO	Investigations indicate low permeability.
Discharge to surface water body	NO	No surface water body available
Discharge to surface water sewer	NO	No highway drains close by.
Discharge to highway drain	NO	No highway drains close by.
Discharge to combined sewer	YES	United Utilities map suggested that a combined drain passes the site.

8.0 CONCLUSION

The EA and Envirocheck Flood Maps indicate that the development site lies within Flood Zone 1, which has a low probability of flooding.

The development is to be used for a car park and therefore in accordance with NPPF Table 2/3, the development is considered to be an acceptable development.

An assessment of potential sources of flood risk including fluvial, pluvial, ground water, drains and sewers, canals and artificial has been carried out, and it is deemed that the probability of flooding from all sources is deemed to be generally low.

Ground investigation is having been carried out to enable the determination of the suitability of the ground to accept surface water run-off from the developed areas of the site to be discharged to an attenuation pond and onto existing pond system. This method of discharge would mimic the natural discharge of water; reduce the surface water run-off rate to Greenfield, and subsequently adhere to the requirements of the current Suds guidance although upon inspection of the trial hole and subsequent permeability testing it was determinate that infiltration testing would not be suitable

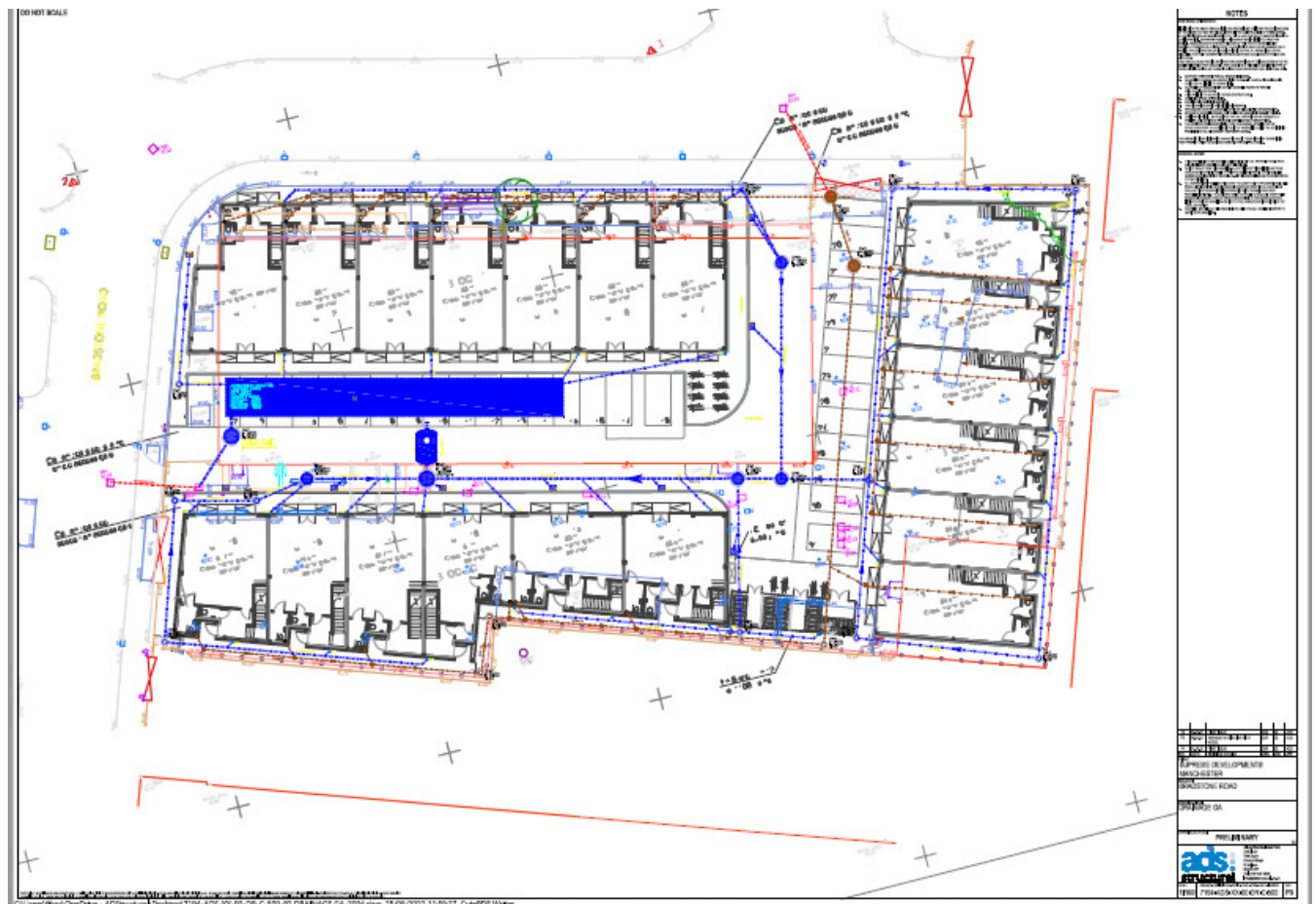
Give the above we advise that the original site was noted as having a 100% impermeable covering and as thus the new development allows for a 50% betterment of the anticipated flows by the installation of a attenuated surface water system.

The system will restrict flows into the adjacent drainage system and reduce the risk of flooding.

The proposed drainage network will be design so that no flooding occurs for up to and including the 1 in 30-year storm event, and that any localised flooding will be controlled for up to and including the 1 in 100-year storm event including 40% rainfall intensity increase (climate change).

There will be no impact on existing flood plain storage as a result of the proposals; the proposed building will not stand within the floodplain nor will any development of any kind, including raising of ground levels, take place within the floodplain. The proposed development will not therefore increase flood risk to the locality.

The development will not increase the risk of flooding for the site or areas within the vicinity of the site. In terms of flood risk, the development is deemed to be appropriate.





MANCHESTER

SUPREME DEVELOPMENTS

BRADSTONE ROAD

DRAINAGE GA

P1	21.04.22	FIRST ISSUE	GOR	DS	DS	AOS	AOS
P2	16.06.22	AMENDMENTS IN LINE WITH MODEL	GOR	DS	DS	AOS	AOS
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P99	21.04.22	FIRST ISSUE	GOR	DS	DS	AOS	AOS
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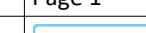
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Innovyze	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Pipe Sizes ADS-STN Manhole Sizes ADS-STD

Designed with Level Inverts

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.178	4-8	0.095

Network Design Table for Storm

Network Results Table

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<p style="text-align: center;"><u>Network Design Table for Storm</u></p> <table><tr><th>PN</th><th>Length (m)</th><th>Fall (m)</th><th>Slope (1:X)</th><th>I.Area (ha)</th><th>T.E. (mins)</th><th>Base Flow (l/s)</th><th>k (mm)</th><th>HYD SECT</th><th>DIA (mm)</th><th>Section</th><th>Type</th><th>Auto Design</th></tr><tr><td>Sw-3.000</td><td>18.141</td><td>0.181</td><td>100.0</td><td>0.001</td><td>4.00</td><td>0.0</td><td>0.600</td><td>o</td><td>100</td><td>Pipe/Conduit</td><td></td><td></td></tr><tr><td>Sw-3.001</td><td>16.375</td><td>0.164</td><td>100.0</td><td>0.000</td><td>0.00</td><td>0.0</td><td>0.600</td><td>o</td><td>100</td><td>Pipe/Conduit</td><td></td><td></td></tr><tr><td>Sw-3.002</td><td>20.843</td><td>0.208</td><td>100.0</td><td>0.000</td><td>0.00</td><td>0.0</td><td>0.600</td><td>o</td><td>100</td><td>Pipe/Conduit</td><td></td><td></td></tr><tr><td>Sw-1.001</td><td>40.353</td><td>0.099</td><td>406.4</td><td>0.000</td><td>0.00</td><td>0.0</td><td>0.600</td><td>o</td><td>150</td><td>Pipe/Conduit</td><td></td><td></td></tr><tr><td>Sw-4.000</td><td>9.180</td><td>0.092</td><td>100.0</td><td>0.005</td><td>4.00</td><td>0.0</td><td>0.600</td><td>o</td><td>100</td><td>Pipe/Conduit</td><td></td><td></td></tr><tr><td>Sw-4.001</td><td>23.900</td><td>0.404</td><td>59.2</td><td>0.000</td><td>0.00</td><td>0.0</td><td>0.600</td><td>o</td><td>100</td><td>Pipe/Conduit</td><td></td><td></td></tr><tr><td>Sw-5.000</td><td>14.604</td><td>0.265</td><td>55.2</td><td>0.018</td><td>4.00</td><td>0.0</td><td>0.600</td><td>o</td><td>100</td><td>Pipe/Conduit</td><td></td><td></td></tr><tr><td>Sw-6.000</td><td>13.300</td><td>0.275</td><td>48.3</td><td>0.012</td><td>4.00</td><td>0.0</td><td>0.600</td><td>o</td><td>100</td><td>Pipe/Conduit</td><td></td><td></td></tr><tr><td>Sw-7.000</td><td>34.845</td><td>0.348</td><td>100.0</td><td>0.031</td><td>4.00</td><td>0.0</td><td>0.600</td><td>o</td><td>150</td><td>Pipe/Conduit</td><td></td><td></td></tr><tr><td>Sw-7.001</td><td>15.346</td><td>0.153</td><td>100.0</td><td>0.000</td><td>0.00</td><td>0.0</td><td>0.600</td><td>o</td><td>150</td><td>Pipe/Conduit</td><td></td><td></td></tr><tr><td>Sw-7.002</td><td>27.792</td><td>0.473</td><td>58.8</td><td>0.000</td><td>0.00</td><td>0.0</td><td>0.600</td><td>o</td><td>150</td><td>Pipe/Conduit</td><td></td><td></td></tr><tr><td>Sw-8.000</td><td>15.860</td><td>0.157</td><td>100.7</td><td>0.017</td><td>4.00</td><td>0.0</td><td>0.600</td><td>o</td><td>150</td><td>Pipe/Conduit</td><td></td><td></td></tr><tr><td>Sw-8.001</td><td>4.038</td><td>0.041</td><td>99.4</td><td>0.033</td><td>0.00</td><td>0.0</td><td>0.600</td><td>o</td><td>225</td><td>Pipe/Conduit</td><td></td><td></td></tr><tr><td>Sw-9.000</td><td>22.676</td><td>0.227</td><td>100.0</td><td>0.010</td><td>4.00</td><td>0.0</td><td>0.600</td><td>o</td><td>100</td><td>Pipe/Conduit</td><td></td><td></td></tr></table>												PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section	Type	Auto Design	Sw-3.000	18.141	0.181	100.0	0.001	4.00	0.0	0.600	o	100	Pipe/Conduit			Sw-3.001	16.375	0.164	100.0	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit			Sw-3.002	20.843	0.208	100.0	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit			Sw-1.001	40.353	0.099	406.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit			Sw-4.000	9.180	0.092	100.0	0.005	4.00	0.0	0.600	o	100	Pipe/Conduit			Sw-4.001	23.900	0.404	59.2	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit			Sw-5.000	14.604	0.265	55.2	0.018	4.00	0.0	0.600	o	100	Pipe/Conduit			Sw-6.000	13.300	0.275	48.3	0.012	4.00	0.0	0.600	o	100	Pipe/Conduit			Sw-7.000	34.845	0.348	100.0	0.031	4.00	0.0	0.600	o	150	Pipe/Conduit			Sw-7.001	15.346	0.153	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit			Sw-7.002	27.792	0.473	58.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit			Sw-8.000	15.860	0.157	100.7	0.017	4.00	0.0	0.600	o	150	Pipe/Conduit			Sw-8.001	4.038	0.041	99.4	0.033	0.00	0.0	0.600	o	225	Pipe/Conduit			Sw-9.000	22.676	0.227	100.0	0.010	4.00	0.0	0.600	o	100	Pipe/Conduit		
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Sw-8.001	4.038	0.041	99.4	0.033	0.00	0.0	0.600	o	225	Pipe/Conduit																																																																																																																																																																																																				
Sw-9.000	22.676	0.227	100.0	0.010	4.00	0.0	0.600	o	100	Pipe/Conduit																																																																																																																																																																																																				
<p style="text-align: center;"><u>Network Results Table</u></p> <table><tr><th>PN</th><th>Rain (mm/hr)</th><th>T.C. (mins)</th><th>US/IL (m)</th><th>Σ I.Area (ha)</th><th>Σ Base Flow (l/s)</th><th>Foul (l/s)</th><th>Add Flow (l/s)</th><th>Vel (m/s)</th><th>Cap (l/s)</th><th>Flow (l/s)</th></tr><tr><td>Sw-3.000</td><td>50.00</td><td>4.39</td><td>51.000</td><td>0.001</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.77</td><td>6.0</td><td>0.1</td></tr><tr><td>Sw-3.001</td><td>50.00</td><td>4.75</td><td>50.819</td><td>0.001</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.77</td><td>6.0</td><td>0.1</td></tr><tr><td>Sw-3.002</td><td>50.00</td><td>5.20</td><td>50.655</td><td>0.001</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.77</td><td>6.0</td><td>0.1</td></tr><tr><td>Sw-1.001</td><td>50.00</td><td>6.57</td><td>49.950</td><td>0.045</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.49</td><td>8.7</td><td>6.1</td></tr><tr><td>Sw-4.000</td><td>50.00</td><td>4.20</td><td>50.916</td><td>0.005</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.77</td><td>6.0</td><td>0.7</td></tr><tr><td>Sw-4.001</td><td>50.00</td><td>4.60</td><td>50.824</td><td>0.005</td><td>0.0</td><td>0.0</td><td>0.0</td><td>1.00</td><td>7.9</td><td>0.7</td></tr><tr><td>Sw-5.000</td><td>50.00</td><td>4.23</td><td>50.663</td><td>0.018</td><td>0.0</td><td>0.0</td><td>0.0</td><td>1.04</td><td>8.2</td><td>2.4</td></tr><tr><td>Sw-6.000</td><td>50.00</td><td>4.20</td><td>50.673</td><td>0.012</td><td>0.0</td><td>0.0</td><td>0.0</td><td>1.11</td><td>8.7</td><td>1.7</td></tr><tr><td>Sw-7.000</td><td>50.00</td><td>4.58</td><td>50.857</td><td>0.031</td><td>0.0</td><td>0.0</td><td>0.0</td><td>1.00</td><td>17.8</td><td>4.3</td></tr><tr><td>Sw-7.001</td><td>50.00</td><td>4.83</td><td>50.509</td><td>0.031</td><td>0.0</td><td>0.0</td><td>0.0</td><td>1.00</td><td>17.8</td><td>4.3</td></tr><tr><td>Sw-7.002</td><td>50.00</td><td>5.18</td><td>50.355</td><td>0.031</td><td>0.0</td><td>0.0</td><td>0.0</td><td>1.31</td><td>23.2</td><td>4.3</td></tr><tr><td>Sw-8.000</td><td>50.00</td><td>4.26</td><td>50.400</td><td>0.017</td><td>0.0</td><td>0.0</td><td>0.0</td><td>1.00</td><td>17.7</td><td>2.3</td></tr><tr><td>Sw-8.001</td><td>50.00</td><td>4.32</td><td>50.243</td><td>0.050</td><td>0.0</td><td>0.0</td><td>0.0</td><td>1.31</td><td>52.1</td><td>6.8</td></tr><tr><td>Sw-9.000</td><td>50.00</td><td>4.49</td><td>50.765</td><td>0.010</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.77</td><td>6.0</td><td>1.4</td></tr></table>												PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	Sw-3.000	50.00	4.39	51.000	0.001	0.0	0.0	0.0	0.77	6.0	0.1	Sw-3.001	50.00	4.75	50.819	0.001	0.0	0.0	0.0	0.77	6.0	0.1	Sw-3.002	50.00	5.20	50.655	0.001	0.0	0.0	0.0	0.77	6.0	0.1	Sw-1.001	50.00	6.57	49.950	0.045	0.0	0.0	0.0	0.49	8.7	6.1	Sw-4.000	50.00	4.20	50.916	0.005	0.0	0.0	0.0	0.77	6.0	0.7	Sw-4.001	50.00	4.60	50.824	0.005	0.0	0.0	0.0	1.00	7.9	0.7	Sw-5.000	50.00	4.23	50.663	0.018	0.0	0.0	0.0	1.04	8.2	2.4	Sw-6.000	50.00	4.20	50.673	0.012	0.0	0.0	0.0	1.11	8.7	1.7	Sw-7.000	50.00	4.58	50.857	0.031	0.0	0.0	0.0	1.00	17.8	4.3	Sw-7.001	50.00	4.83	50.509	0.031	0.0	0.0	0.0	1.00	17.8	4.3	Sw-7.002	50.00	5.18	50.355	0.031	0.0	0.0	0.0	1.31	23.2	4.3	Sw-8.000	50.00	4.26	50.400	0.017	0.0	0.0	0.0	1.00	17.7	2.3	Sw-8.001	50.00	4.32	50.243	0.050	0.0	0.0	0.0	1.31	52.1	6.8	Sw-9.000	50.00	4.49	50.765	0.010	0.0	0.0	0.0	0.77	6.0	1.4																														
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Date 20/05/2022 13:43 File DRAINAGE MODEL-P2.MDX					Designed by GlynRatcliffe Checked by							
Innovyze					Network 2020.1.3							
Network Design Table for Storm												
PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section	Type	Auto Design
Sw-9.001	14.161	0.336	42.1	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit		
Sw-8.002	5.239	0.052	100.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit		
Sw-10.000	3.859	0.455	8.5	0.012	4.00	0.0	0.600	o	100	Pipe/Conduit		
Sw-8.003	22.319	0.079	282.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit		
Sw-11.000	19.303	0.064	303.4	0.023	4.00	0.0	0.600	o	150	Pipe/Conduit		
Sw-11.001	13.110	0.064	206.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit		
Sw-11.002	8.878	0.250	35.6	0.011	0.00	0.0	0.600	o	150	Pipe/Conduit		
Sw-11.003	2.113	0.119	17.7	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit		
Sw-11.004	13.968	0.427	32.7	0.021	0.00	0.0	0.600	o	150	Pipe/Conduit		
Sw-8.004	8.276	0.050	167.0	0.034	0.00	0.0	0.600	o	225	Pipe/Conduit		
Sw-1.002	11.581	0.061	188.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit		
Sw-1.003	12.088	0.023	533.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit		
Network Results Table												
PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)		
Sw-9.001	50.00	4.69	50.538	0.010	0.0	0.0	0.0	1.19	9.4	1.4		
Sw-8.002	50.00	4.76	50.202	0.060	0.0	0.0	0.0	1.31	52.0	8.2		
Sw-10.000	50.00	4.02	50.605	0.012	0.0	0.0	0.0	2.67	21.0	1.6		
Sw-8.003	50.00	5.24	50.150	0.072	0.0	0.0	0.0	0.77	30.7	9.7		
Sw-11.000	50.00	4.56	50.800	0.023	0.0	0.0	0.0	0.57	10.1	3.2		
Sw-11.001	50.00	4.88	50.736	0.023	0.0	0.0	0.0	0.70	12.3	3.2		
Sw-11.002	50.00	4.96	50.673	0.034	0.0	0.0	0.0	1.69	29.9	4.6		
Sw-11.003	50.00	4.98	50.423	0.034	0.0	0.0	0.0	2.41	42.5	4.6		
Sw-11.004	50.00	5.11	50.304	0.055	0.0	0.0	0.0	1.77	31.2	7.5		
Sw-8.004	50.00	5.37	49.877	0.161	0.0	0.0	0.0	1.01	40.1	21.8		
Sw-1.002	50.00	6.73	49.827	0.273	0.0	0.0	0.0	1.14	80.7	37.0		
Sw-1.003	50.00	7.09	49.766	0.273	0.0	0.0	0.0	0.56	22.2	37.0		
Free Flowing Outfall Details for Storm												
Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)						
Sw-1.003	MH-26	51.333	49.743	49.450	0	0						
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Alexandra Business Park 2nd Floor, The Court, Prescott Road St Helens, WA10 3TP	SUPREME DEVOPMENTS MANCHESTER BRADSTONE ROAD 7194 P2	
Date 20/05/2022 13:43 File DRAINAGE MODEL-P2.MDX	Designed by GlynRatcliffe Checked by	
Innovyze	Network 2020.1.3	
<p style="text-align: center;"><u>Simulation Criteria for Storm</u></p> <p> Volumetric Runoff Coeff 0.750 Additional Flow - % of Total Flow 0.000 Areal Reduction Factor 1.000 MADD Factor * 10m³/ha Storage 2.000 Hot Start (mins) 0 Inlet Coefficient 0.800 Hot Start Level (mm) 0 Flow per Person per Day (l/per/day) 0.000 Manhole Headloss Coeff (Global) 0.500 Run Time (mins) 60 Foul Sewage per hectare (l/s) 0.000 Output Interval (mins) 1 </p> <p> Number of Input Hydrographs 0 Number of Storage Structures 1 Number of Online Controls 1 Number of Time/Area Diagrams 0 Number of Offline Controls 0 Number of Real Time Controls 0 </p> <p style="text-align: center;"><u>Synthetic Rainfall Details</u></p> <p> Rainfall Model FSR Profile Type Summer Return Period (years) 2 Cv (Summer) 0.750 Region England and Wales Cv (Winter) 0.840 M5-60 (mm) 18.000 Storm Duration (mins) 30 Ratio R 0.355 </p>		
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Innovyze	Network 2020.1.3																																																																									
<div>Online Controls for Storm</div> <div>Hydro-Brake® Optimum Manhole: MH-ATT-TK, DS/PN: Sw-1.002, Volume (m³): 1.9</div> <div><div>Unit Reference MD-SHE-0155-1050-0550-1050</div><div>Design Head (m)0.550</div><div>Design Flow (l/s)10.5</div><div>Flush-Flo™Calculated</div><div>ObjectiveMinimise upstream storage</div><div>ApplicationSurface</div><div>Sump AvailableYes</div><div>Diameter (mm)155</div><div>Invert Level (m)49.827</div><div>Minimum Outlet Pipe Diameter (mm)225</div><div>Suggested Manhole Diameter (mm)1200</div></div> <div><div>Control Points</div><div>Head (m)Flow (l/s)</div><div>Design Point (Calculated)0.55010.5</div><div>Flush-Flo™0.23610.5</div><div>Kick-Flo®0.4309.3</div><div>Mean Flow over Head Range-8.4</div></div> <div>The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated</div> <div><table><tr><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td></tr><tr><td>0.100</td><td>5.6</td><td>1.200</td><td>15.2</td><td>3.000</td><td>23.5</td><td>7.000</td><td>35.3</td></tr><tr><td>0.200</td><td>10.4</td><td>1.400</td><td>16.3</td><td>3.500</td><td>25.3</td><td>7.500</td><td>36.6</td></tr><tr><td>0.300</td><td>10.4</td><td>1.600</td><td>17.4</td><td>4.000</td><td>27.0</td><td>8.000</td><td>37.8</td></tr><tr><td>0.400</td><td>9.8</td><td>1.800</td><td>18.4</td><td>4.500</td><td>28.6</td><td>8.500</td><td>39.0</td></tr><tr><td>0.500</td><td>10.0</td><td>2.000</td><td>19.4</td><td>5.000</td><td>30.1</td><td>9.000</td><td>40.1</td></tr><tr><td>0.600</td><td>10.9</td><td>2.200</td><td>20.3</td><td>5.500</td><td>31.5</td><td>9.500</td><td>41.2</td></tr><tr><td>0.800</td><td>12.5</td><td>2.400</td><td>21.1</td><td>6.000</td><td>32.7</td><td></td><td></td></tr><tr><td>1.000</td><td>13.9</td><td>2.600</td><td>21.9</td><td>6.500</td><td>34.0</td><td></td><td></td></tr></table></div> <div>©1982-2020 Innovyze</div>			Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	5.6	1.200	15.2	3.000	23.5	7.000	35.3	0.200	10.4	1.400	16.3	3.500	25.3	7.500	36.6	0.300	10.4	1.600	17.4	4.000	27.0	8.000	37.8	0.400	9.8	1.800	18.4	4.500	28.6	8.500	39.0	0.500	10.0	2.000	19.4	5.000	30.1	9.000	40.1	0.600	10.9	2.200	20.3	5.500	31.5	9.500	41.2	0.800	12.5	2.400	21.1	6.000	32.7			1.000	13.9	2.600	21.9	6.500	34.0		
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)																																																																			
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Date 20/05/2022 13:43 File DRAINAGE MODEL-P2.MDX	Designed by GlynRatcliffe Checked by																			
Innovyze	Network 2020.1.3																			
<div>Storage Structures for Storm</div> <div>Cellular Storage Manhole: MH-ATT-TK, DS/PN: Sw-1.002</div> <div>Invert Level (m) 49.827 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000</div> <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>110.0</td><td>540.0</td><td>0.551</td><td>0.0</td><td>759.6</td></tr><tr><td>0.550</td><td>110.0</td><td>759.6</td><td></td><td></td><td></td></tr></tbody></table>			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	110.0	540.0	0.551	0.0	759.6	0.550	110.0	759.6			
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)															
0.000	110.0	540.0	0.551	0.0	759.6															
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Innovyze	Network 2020.1.3		
<u>100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>			
PN	US/MH Name	Status	Level Exceeded
Sw-8.000	MH-RG-1	SURCHARGED*	
Sw-8.001	MH-15	SURCHARGED	
Sw-9.000	MH-RWP-8	SURCHARGED*	
Sw-9.001	MH-08	SURCHARGED	
Sw-8.002	MH-09	FLOOD RISK	
Sw-10.000	MH-RWP-4	SURCHARGED*	
Sw-8.003	MH-JUN	SURCHARGED*	
Sw-11.000	MH-RWP-9	SURCHARGED*	
Sw-11.001	MH-04	FLOOD RISK	
Sw-11.002	MH-05	FLOOD RISK	
Sw-11.003	MH-06	FLOOD RISK	
Sw-11.004	MH-07	FLOOD	2
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