

Flood Risk Assessment & Drainage Strategy

Proposed Short Stay Car Park,

Middleton Shopping Centre,

Middleton,

Rochdale,

M24 4EL

Prepared For

Ellandi

Report: 7137-HJCE-ZZ-XX-RP-3000

Date: 28.02.23

Document Revisions

Revision	Date	Written by	Checked by
P01	28.02.23	DM	MH
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Table of Contents

Document Revisions 2

Table of Contents 3

Appendices..... 3

2. Methodology 5

3. Site Details 6

4. The Proposed Development 7

5. Flood Risk Planning Policy 7

6. Historical Flooding 9

7. Flood Risk Assessment 9

8. Flood Avoidance, Resistance and Resilience 13

9. Flood Risk Assessment Conclusion 14

10. Drainage Strategy 15

Appendices

Appendix A Site Location Plan

Appendix B Environment Agency Flood Zone Map

Appendix C Environment Agency Fluvial Flood Map

Appendix D Environment Agency Pluvial Flood Map

Appendix E Historic Sewer Flood Map

Appendix F Drainage Strategy Drawing

Appendix G Borehole Logs

Appendix H Existing Site Plan

Appendix I Groundwater Flood Risk Map

Appendix J Drainage Survey

Appendix K Introduction

- 1.1. This Flood Risk Assessment (FRA) has been produced by Holloway Jennings on behalf of Ellandi. It supports the planning application for the proposed development at Middleton Shopping Centre. The proposal is to construct new parking to the front of the existing shopping centre. For clarity in this report, the site shall be referred to as ‘the site’.
- 1.2. This FRA has been prepared in accordance with the requirements set out in the National Planning Policy Framework (NPPF) 2021 and the associated Planning Practice Guidance.
- 1.3. The key site details are below.
- | | |
|------------------------------|---|
| - Site Name | Middleton Shopping Centre Short Stay Car Park |
| - Location | Middleton, Rochdale |
| - Grid Reference | SD 86849 05742 |
| - Postcode (nearest) | M24 4EL |
| - Site Area (hectares) | 0.14 ha |
| - Development Type | Commercial |
| - Flood Zone | Flood Zone 2 |
| - NPPF Vulnerability | Less Vulnerable |
| - Surface Water Flood Risk | High Risk |
| - Lead Local Flood Authority | Rochdale MBC |
| - Local Planning Authority | Rochdale MBC |
- 1.4. The site is within Flood Zone 2. Whilst the site area is less than one hectare, because the development site may be affected by sources of flooding other than rivers, the NPPF states that a FRA should be carried out.
- 1.5. This report is a FRA and, therefore, deals with environmental issues only in as much as they are impacted by flooding. The report is the property of Holloway Jennings Consulting Engineers (HJCE) and is produced for the exclusive use of the client, Ellandi. The contents may not be made use of by any third party without the express written consent of HJCE. Without such consent HJCE can accept no responsibility to any third party. By receiving this report and acting on it, the client, or any third party relying on it, accepts that no individual is personally liable in contract, tort, or breach of statutory duty (including negligence).

2. Methodology

- 2.1. This is a desk-based study that utilises existing information in the form of mapping and previously undertaken work. Conclusions made about flooding have been made using our expert judgement and knowledge of similar events.
- 2.2. In preparing this report, information has been gathered and referenced from a number of sources. These are as follows:
- The Environment Agency's Flood Map for Planning
 - The Risk of Flooding from Surface Water (RoFfSW) Mapping
 - Greater Manchester Combined Authority (GMCA) Strategic Flood Risk Assessment (SFRA)
 - Rochdale MBC Strategy for Flood Risk Management (SFRM)
 - The 2021 NPPF
 - The Planning Practice Guidance to the 2021 NPPF
 - Risk of Flooding from Surface Water Data Download (RoFSW)

3. Site Details

3.1. Site Location & Characteristics

3.1.1. The site is located adjacent to the existing shopping centre located to the north of the A576, at the centre of Middleton, Rochdale.

3.1.2. Currently, the site is an open area for pedestrian use only. Historically, the area was part of an access road associated with the now re-developed bus station to the south. Middleton Shopping Centre was also extended as part of the re-development of the area.

3.1.3. Vehicle access is provided to the site via Manchester New Road, while pedestrian access is from the shopping centre, the bus station and surrounding amenities.

3.1.4. The total development site covers approximately 0.14 hectares.

3.1.5. Middleton Shopping Centre bounds the north west and south west of the site, the bus station access road runs along the southern boundary and a vehicle turning area is to the east.

3.1.6. See **Appendix A** for location maps of the site.

3.2. Geology

3.2.1. Borehole logs undertaken in 2015 indicate that made ground is present to a depth of 1.9m BGL. Below this, the strata consists mostly sand deposits, with small deposits of clay. Water was encountered at 2.7m BGL. Logs can be found in **Appendix G**.

3.2.2. The British Geological Survey on shore borehole index has a record of historical boreholes in the area. Upon review, the natural strata begins below made ground at around 1.5m BGL. Deposits largely consist irregular build ups of boulder clay and sand/ gravel.

3.2.3. The BGS Geology Viewer indicates that located below the site are superficial deposits of alluvium consisting of clay, silt and gravel are underlain by the Pennine Lower Coal Measures Formation consisting of mudstone, siltstone and sandstone.

3.3. Topography

3.3.1. Levels generally fall from the north-east to the south-west of the site. The vehicle turning area falls from north to south generally. An existing site plan can be found in **Appendix H**.

3.4. Surface Water Features

3.4.1. There are no surface water features on the site.

3.4.2. The River Irk runs through a culvert 50+ metres south of the site, adjacent to the bus station.

3.5. Sewer Network

3.5.1. A drainage survey has been undertaken on site which confirms the presence of both combined and surface water drains/sewers within the site boundary. A copy of the survey can be found in **Appendix J**.

4. The Proposed Development

4.1. The proposal is to provide short stay parking and turning facilities to serve units G34-G46 of the Middleton Shopping Centre. It is proposed that levels on site will remain largely unchanged; a kerb upstand through vehicle routes will be provided.

5. Flood Risk Planning Policy

5.1. The Environment Agency Flood Map for Planning

5.1.1. The Environment Agency's Flood Map for Planning gives an indicative prediction of areas at risk of fluvial and tidal flooding. The mapping is an amalgamation modelled flood levels and historical flood event outlines.

5.1.2. The Flood Map is split into 'Flood Zones', which demarcate the extent of flooding from rivers or the sea for different return periods. The Flood Map for Planning shows the extent of the natural floodplain if there were no defences or other man-made structures. They do not provide a definitive picture of where flooding would occur; rather, they provide an indicative prediction of areas at risk.

5.2. National Planning Policy Framework

5.2.1. The NPPF sets out the Government's national policies on different aspects of land use planning in England in relation to flood risk. The Planning Practice Guidance to the NPPF provides further information on the policies set out in the NPPF. It encourages development to be located in areas of lower flood risk wherever possible and stresses the importance of preventing increases in flood risk off site to the wider catchment area.

5.2.2. Within each Flood Zone, a key factor in determining planning applications for development is the flood risk vulnerability of a development. Table 2 of the Planning Practice Guidance to the NPPF categorises different development types according to their vulnerability to flooding. These categories are:

- Essential infrastructure;
- Highly vulnerable development;
- More vulnerable development;

- Less vulnerable development, and;
- Water-compatible development.

5.2.3. Within the different Flood Zones each of the above development categories are considered appropriate or not permissible. The Planning Practice Guidance to the NPPF lists these as:

- Flood Zone 1:

5.2.4. All the development categories listed above are appropriate

- Flood Zone 2:

5.2.5. Water-compatible, less vulnerable development, more vulnerable development and essential infrastructure is appropriate in this zone.

- Flood Zone 3a:

5.2.6. Water-compatible and less vulnerable development is appropriate in this zone. Highly vulnerable development should not be permitted in this zone.

- Flood Zone 3b:

5.2.7. Only water-compatible development and essential infrastructure that has to be there should be permitted in this zone.

5.2.8. The above information sets out the basis by which developments must be assessed in terms of flood risk. In Section 8, below, the vulnerability of the proposed development at Middleton Shopping Centre will be reviewed against the Flood Zone in which it is located. This will inform the appropriateness of the development as per the advice within the Planning Practice Guidance of the NPPF.

5.3. Strategic Flood Risk Assessment

5.3.1. A Strategic Flood Risk Assessment (SFRA) is a study carried out by one or more local planning authorities to assess the risk to an area from flooding from all sources, now and in the future. GMCA has produced an SFRA. The SFRA has been produced to facilitate the application of the Sequential and Exception Tests to screen allocated development sites.

5.4. Strategy for Flood Risk Management

5.4.1. A Strategy for Flood Risk Management (SFRM) is prepared by the LLFA to ensure that knowledge of local flood risk issues is communicated effectively so that they can be better managed within their area. Rochdale MBC SFRM aims to provide an understanding of flood risk from all sources in the city, reduce its likelihood and impact on residents and visitors and take the opportunity to improve the city environment.

6. Historical Flooding

- 6.1. The historic flood data held by the Environmental Agency demonstrates the maximum extent of individual Recorded Flood Outlines from river, the sea and groundwater springs that meet a set criteria. It shows areas of land that have previously been subject to flooding in England. This excludes flooding from surface water, except in areas where it is impossible to determine whether the source is fluvial or surface water but the dominant source is fluvial.
- 6.2. The GMCA SFRA mapping indicates no historic flooding within the site extents. The map is available in **Appendix E**.

7. Flood Risk Assessment

- 7.1. Flooding can arise from a variety or combination of sources which may be natural or artificial and may be affected by climate change. These are discussed below.
- 7.2. Rivers and Seas (Fluvial) Flood Risk
 - 7.2.1. The nearest river is the River Irk, approximately 50m south of the site.
 - 7.2.2. The Environment Agency Flood Map for Planning (see **Appendix B**) indicates the site is located in Flood Zone 2. The risk of flooding from fluvial sources is considered to be low.
 - 7.2.3. The EA fluvial flood risk map can be found in **Appendix C**.
 - 7.2.4. The site is not in an area at risk of tidal flooding.
- 7.3. Groundwater Flood Risk
 - 7.3.1. The risk of groundwater flooding is dependent on local geological and hydrogeological conditions at any given time. Groundwater levels rise during wet winter months and fall again in the summer when rainfall is low and extractions are higher. In very wet winters, rising groundwater levels can reactivate flow in ephemeral streams that only flow for part of the year or even lead to the flooding of normally dry land.
 - 7.3.2. The Rochdale SFRM indicates that the site is within an area with a 25% to 50% chance of flooding from groundwater sources. A plan can be found in **Appendix I**.
 - 7.3.3. BGS Mapping indicates the site is underlain by both bedrock and superficial drift secondary A aquifers. This indicates that the strata below the site comprise of permeable layers that can support local water supplies, and may form a source of river base flow.
 - 7.3.4. Based on the anticipated ground conditions, it is considered that groundwater flood risk is low. Though the site is located within an area with highly permeable layers which could indicate a risk of groundwater arising at surface level, other factors such as localised topography can affect the susceptibility of groundwater flooding. In the case of the site,

groundwater has been discovered at a depth of 2.7m BGL, therefore making the risk of groundwater flooding minimal.

7.4. Surface Water (Pluvial) Flood Risk

7.4.1. Pluvial flooding results from rainfall-generated overland flow, where rainwater has not yet reached a watercourse or sewer and where the local drainage systems become overwhelmed. Pluvial flooding often occurs during short, very intense storms, but can also occur during longer periods of rainfall when the ground is already saturated, or where land has low permeability due to development.

7.4.2. Pluvial flooding is exacerbated in many cases by the mistreatment or failure of the below ground infrastructure (including partial or full blockages of gullies and/or within the combined sewers and the accumulation of fats, oils and greases within the sewer networks).

7.4.3. The Environment Agency's Risk of Flooding from Surface Water (RoFSW) maps attempt to model the areas where pluvial flooding is likely to occur. It shows the flooding that could take place from the 'surface runoff' generated by rainwater (including snow and other precipitation) which:

- a. is on the surface of the ground (whether or not it is moving), and
- b. has not yet entered a watercourse, drainage system or public sewer.

7.4.4. The RoFSW map predominantly follows topographical flow paths of existing watercourses, or dry valleys with some isolated ponding located in low lying areas.

7.4.5. The RoFSW maps are categorised into High, Medium and Low risk, and correlate to 1 in 30, 1 in 100 and 1 in 1000 chance of flooding in each year respectively.

7.4.6. The topography of the site indicates that surface water exceedance flows would traverse the site from the north east, down to the south west.

7.4.7. Mapping indicates the majority of the site lies within a medium risk area, though areas of high risk are noted. A plan can be found in **Appendix D**.

7.4.8. To ensure the development does not cause increased risk of flooding elsewhere then any loss of flood storage volume arising from the development of the site should be compensated for by providing additional storage elsewhere on site. Where it is not practicable to provide this directly then any proposed on-site storage capacity could be increased to also include the same volume of storage.

- 7.4.9. In summary, the pluvial flood risk mapping indicates that the majority of the site lies within a medium flood risk area, with areas of high risk present. As a result, levels on site should not be changed significantly in such a way that on site or third party flood risk is affected.
- 7.5. Flood Risk from Canals
- 7.5.1. There are no purpose-built or artificial canals or navigable waterways in the vicinity of the development site.
- 7.6. Flood Risk from Reservoirs and Large Water Bodies
- 7.6.1. Flooding can occur from reservoirs or large water bodies if they are impounded above the surrounding ground levels, or are used to retain water in times of flood. Although unlikely, reservoirs and large waterbodies can overtop or breach their impounding structures leading to rapid inundation of the downstream floodplain.
- 7.6.2. There are no storage reservoirs or large water bodies 'upstream' of the development site that pose a risk of reservoir flooding.
- 7.7. Flood Risk from Sewers
- 7.7.1. Flooding can result when the sewers are overwhelmed by intense rainfall and this can be aggravated by inadequate capacity or blockage, or when river levels are high and the sewers cannot freely discharge.
- 7.7.2. There are several drains and sewers that have been identified through a drainage survey on site.
- 7.7.3. A review of the SFRA maps indicates that there are no known instances where sewer flooding was recorded within the area surrounding the site. However, this simply indicates that no flooding was reported, though flooding may still have occurred.
- 7.8. Climate Change
- 7.8.1. The NPPF and the supporting Planning Practice Guidance document sets out how flood risk should be considered over the lifetime of a development. This requires an increase in flood risk due to climate change to be taken into account. Both peak river flows and rainfall intensity should be assessed.
- 7.8.2. Peak River Flows
- 7.8.2.1. A range of climate change allowances have been provided by the NPPF for peak river flow increases - a 'central' allowance, a 'higher central' allowance and an 'upper end' allowance. The flood zone and risk vulnerability classification of the development decide which allowance to consider.

7.8.2.2. As the site is located within Flood Zone 2, and the development is classified as less vulnerable, the central allowance should be utilised. For the Irwell Management Catchment, the percentage river flow allowance should be 19% for the 2050s.

7.8.2.3. Without site-specific modelling, there can be no definitive conclusion regarding whether an increase in peak river flows of 19% will pose a risk to the development site. However, the nearest outline for Flood Zone 3 is circa 3m below the average site level, therefore it is unlikely that flood levels will rise to present a significant increase in flood risk from fluvial sources.

7.9. Peak Rainfall Intensity

7.9.1. For the 2050s, an increase in peak rainfall within the Irwell Management Catchment of 25% should be adopted, while ensuring that there is no increase in flood risk with a 40% increase.

7.9.2. It is proposed that the site levels remain largely unchanged, and as such, the development of the site will not influence the affects of climate change on the ability of the local surface water network.

7.9.3. Further flood resistance/resilience measures that may be considered appropriate to the development are discussed, below. A pragmatic approach in the face of likely risks is the best approach.

7.10. Residual Flood Risk

7.10.1. It is important to recognise that flood risk can never be fully mitigated and there will always be a residual risk of flooding.

7.10.2. The residual risk is associated with a number of potential risk factors, including (but not limited to):

7.10.2.1. A flood event that exceeds that for which the local flood defences or local drainage system has been designed to withstand.

7.10.2.2. A residual danger posed to property and life as a result of flood defence failure through overtopping or structural collapse.

7.10.2.3. General uncertainties inherent in the prediction of flooding.

7.10.3. Modelling of flood events is not an exact science. Therefore, there is an inherent uncertainty in the prediction of flood levels and extents used in the assessment of flood risk. The Environment Agency's Flood Map, surface water mapping and groundwater flood mapping are largely based upon detailed modelling within the area. Whilst they provide a good depiction

of flood risk for specific modelled conditions, all detailed modelling requires the making of core assumptions and these might not occur in the open and dynamic environment of a flood event.

8. Flood Avoidance, Resistance and Resilience

8.1. Flood risk can be ameliorated through taking measures to avoid, resist and be resilient to flooding. Avoidance is carrying out development in line with the sequential test and relocating development to areas of lower flood risk. There are a range of construction methods that can be incorporated into the design of new development to reduce the risk of flooding at a site. These can either be categorised as resistance or resilience measures. Resistance measures are those used to try to prevent floodwaters from reaching or entering a property. Resilience measures are those that acknowledge that flooding is likely to occur and try to minimise the damage caused by floodwaters entering the building. The Environment Agency recommends consideration be given to the incorporation of flood resistance and resilience into the design and construction of a development in areas that are at risk of flooding. Avoidance, resistance and resilience is discussed in the context of the development site, below.

8.2. Sequential test

8.2.1. The site is located within Flood Zone 2, and is in an area with a high risk of surface water flooding. However, the development is deemed to be a minor development, and therefore does not require the sequential test.

8.3. Exception Test

8.3.1. As the development has passed the sequential test, the exception test is not required.

8.4. Avoidance

8.4.1. The best possible mitigation for properties at risk of flooding would be to relocate the building to an area of lower flood risk. This method is regarded as an avoidance measure. In the case of the development site, this is not applicable because less vulnerable development is proposed, suitable for this level of flood risk

8.5. Resistance

8.5.1. Resistance measures can help to prevent water from entering a property. This is particularly effective for low depth of floodwaters and surface water flooding. For flood depths of less than 300mm it is recommended to raise the threshold of a property to above the predicted flood levels. In this instance, no buildings are proposed and therefore increasing levels is not applicable.

8.6. Resilience

8.6.1. Resilience measures do not stop water from entering a property; they acknowledge that there will be floodwater ingress and aim to minimise the impact in terms of cost and disruption immediately after a flood event. There is no increased risk of flood water ingress.

8.6.2. It is the conclusion of this report that the flood risks at the development site are not sufficient to require flood resilient construction methods. It would represent unnecessary cost for the development.

9. Flood Risk Assessment Conclusion

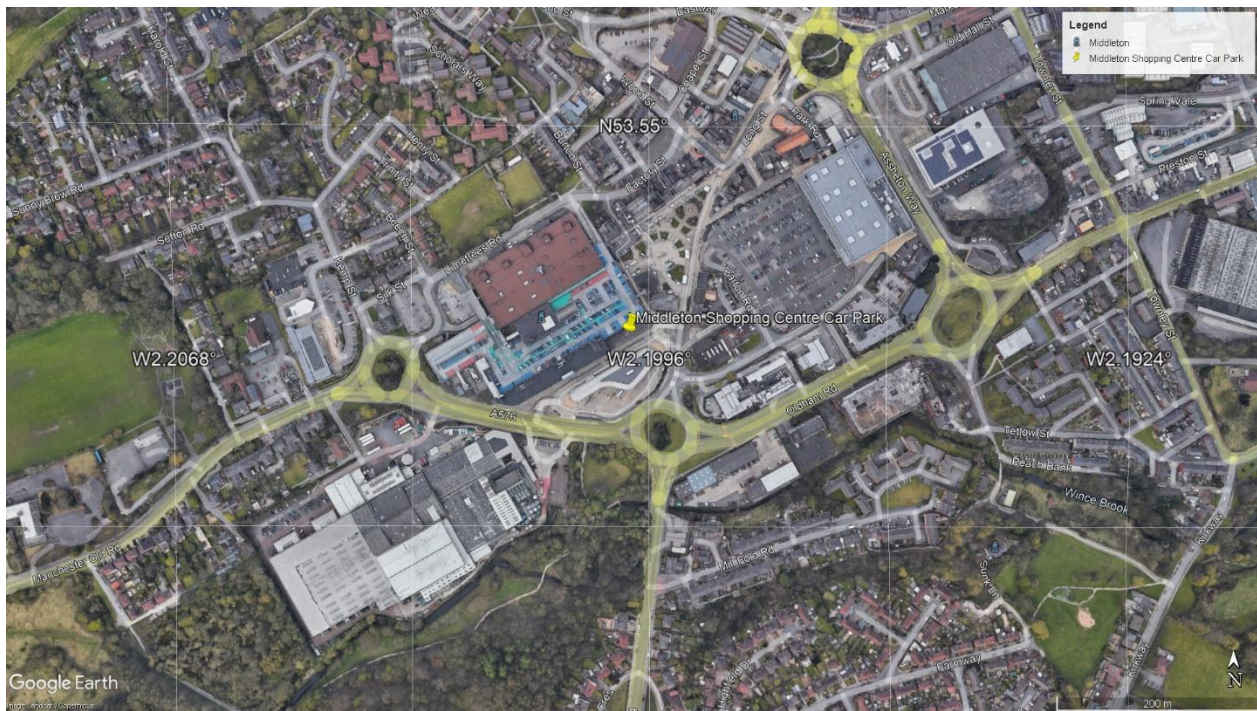
- 9.1. This Flood Risk Assessment (FRA) supports the planning application for the proposed short stay car park at Middleton Shopping Centre.
- 9.2. This FRA has been prepared in accordance with the requirements set out in the National Planning Policy Framework (NPPF) 2021 and the associated Planning Practice Guidance.
- 9.3. The Environment Agency's Flood Map for Planning indicates that the development site is within Flood Zone 2. Table 3 of the Planning Practice Guidance to the NPPF states that 'less vulnerable' development is appropriate in Flood Zones 1 and 2, which have the same level of probability as the surface water flooding occurring on site. Consequently, the development can be considered to be appropriate in this location, according to the NPPF.
- 9.4. Changes to flood risk as a result of climate change have also been assessed and it has been concluded that peak river flows and surface water flood risk will not increase significantly in the area of the development.
- 9.5. Flood risk from other sources (groundwater, canals, reservoirs and sewers) has also been reviewed and found to be low.

10. Drainage Strategy

- 10.1. Surface water flows on site are currently collected via a positive drainage system. A single gully is located at the centre of the existing plaza, with a linear drain on the north western edge, parallel with the adjacent building wall. Flows at the vehicle turning area are flow north to south to a series of gullies.
- 10.2. Flows are discharged into the existing 450mm diameter surface water sewer that exits below the existing shopping centre on the south western boundary.
- 10.3. It is proposed that flows arising on the parking area will continue to drain from the north east to the south west and be collected via a network of collection drains prior to discharge into the existing 450mm diameter surface water drain located on site.
- 10.4. The entrance to the site will be subject to layout alterations, though levels in this area will be retained as close as possible to existing. Gully locations will be adjusted to suit the location of low points.
- 10.5. A drainage layout can be found in **Appendix F**.

Appendix A

Site Location Plan



Job Ref – 7137

Job Name – Middleton Shopping Centre Car Park

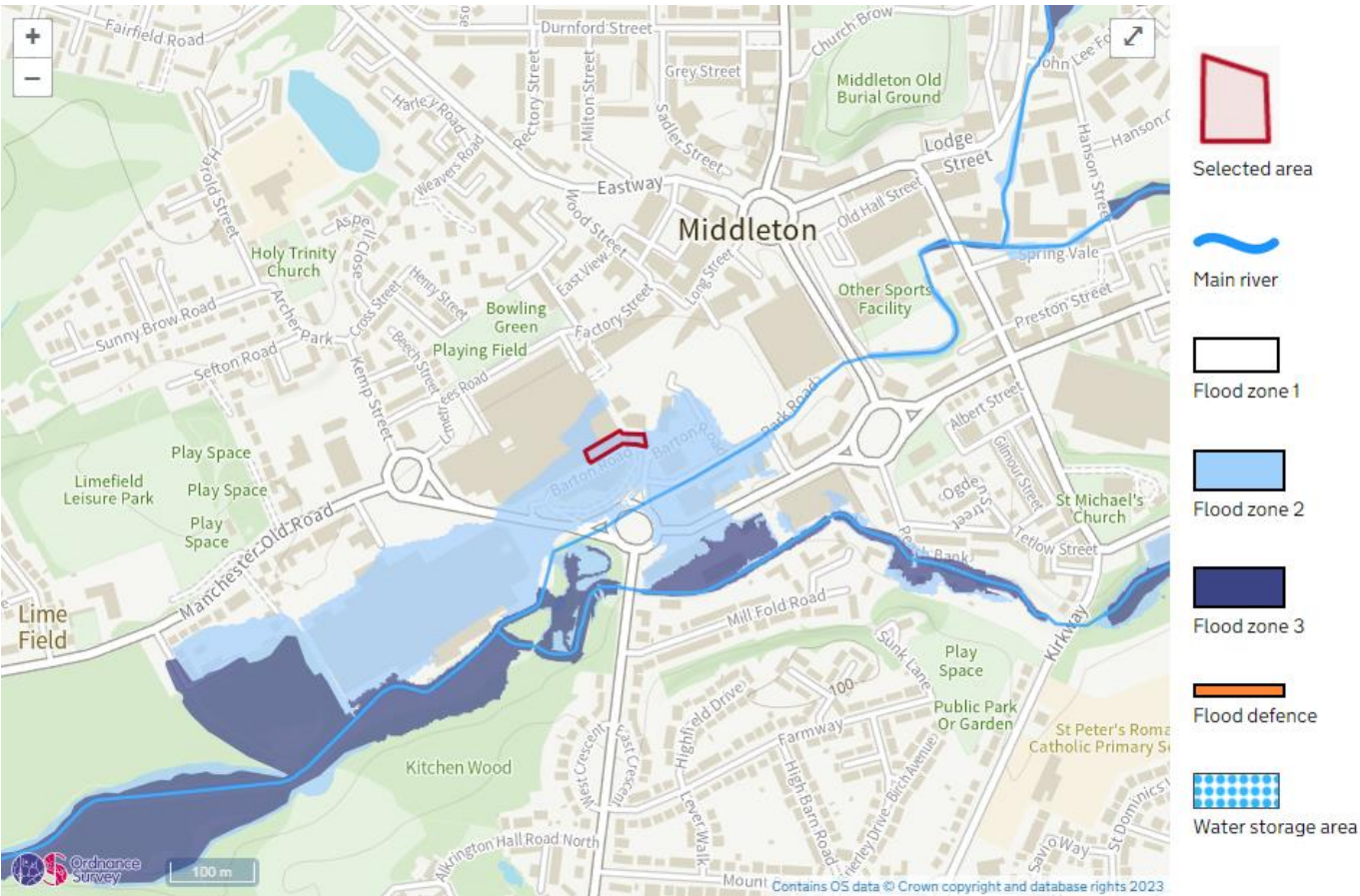
Site Address – Middleton, Rochdale

Post Code (Nearest) – M24 4DB

NGR – SD 86849 05742

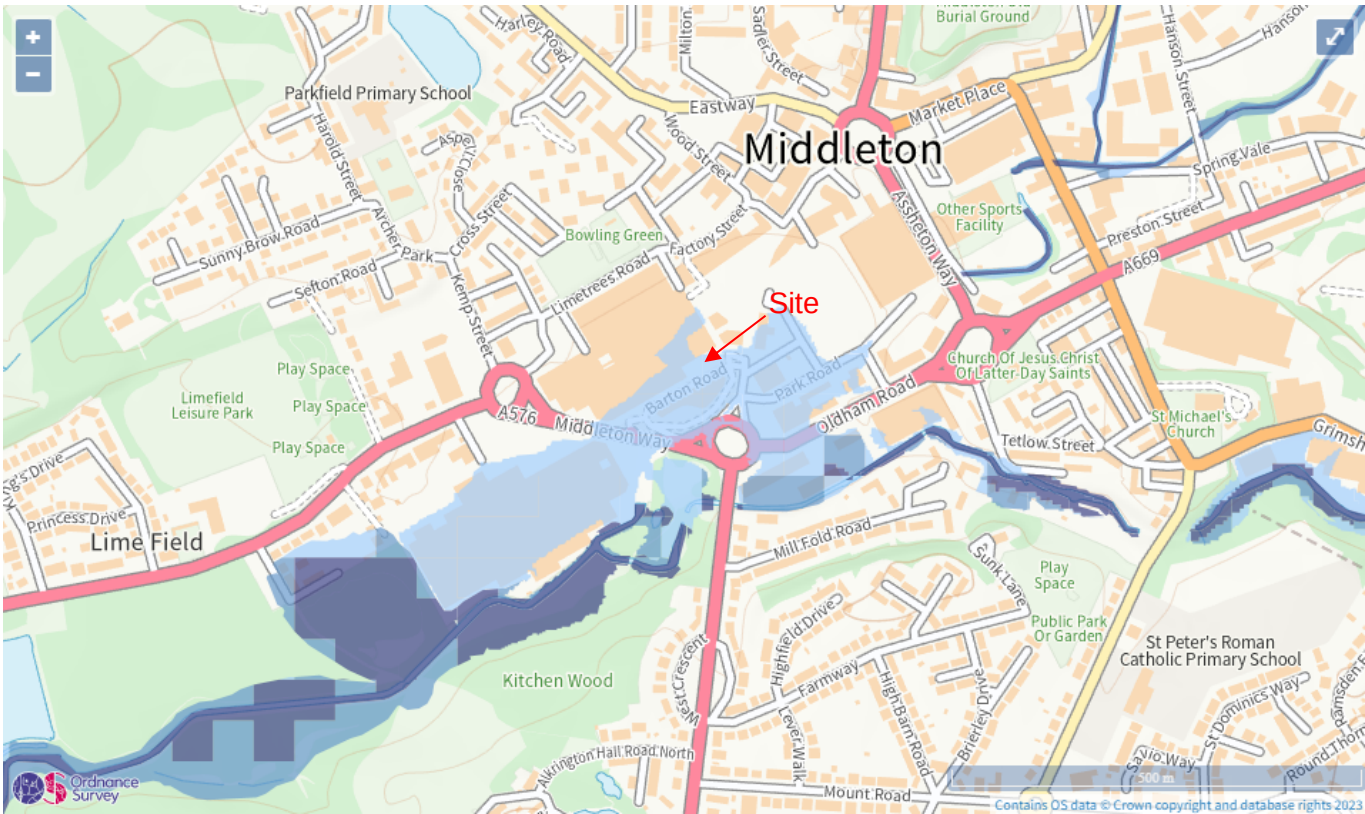
Appendix B

Environment Agency Flood Zone Map



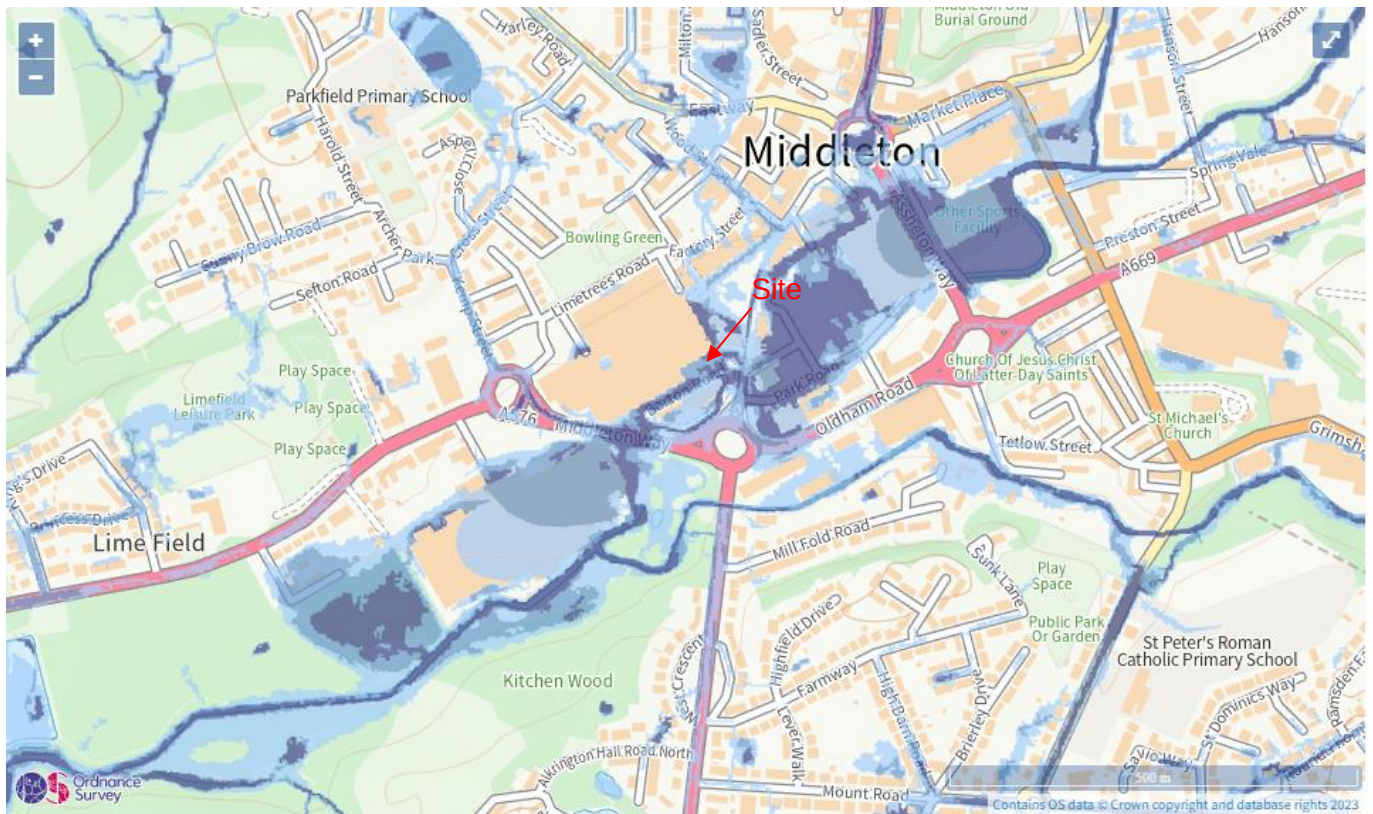
Appendix C

Environment Agency Fluvial Flood Map

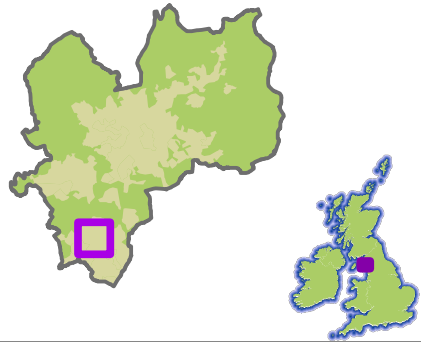
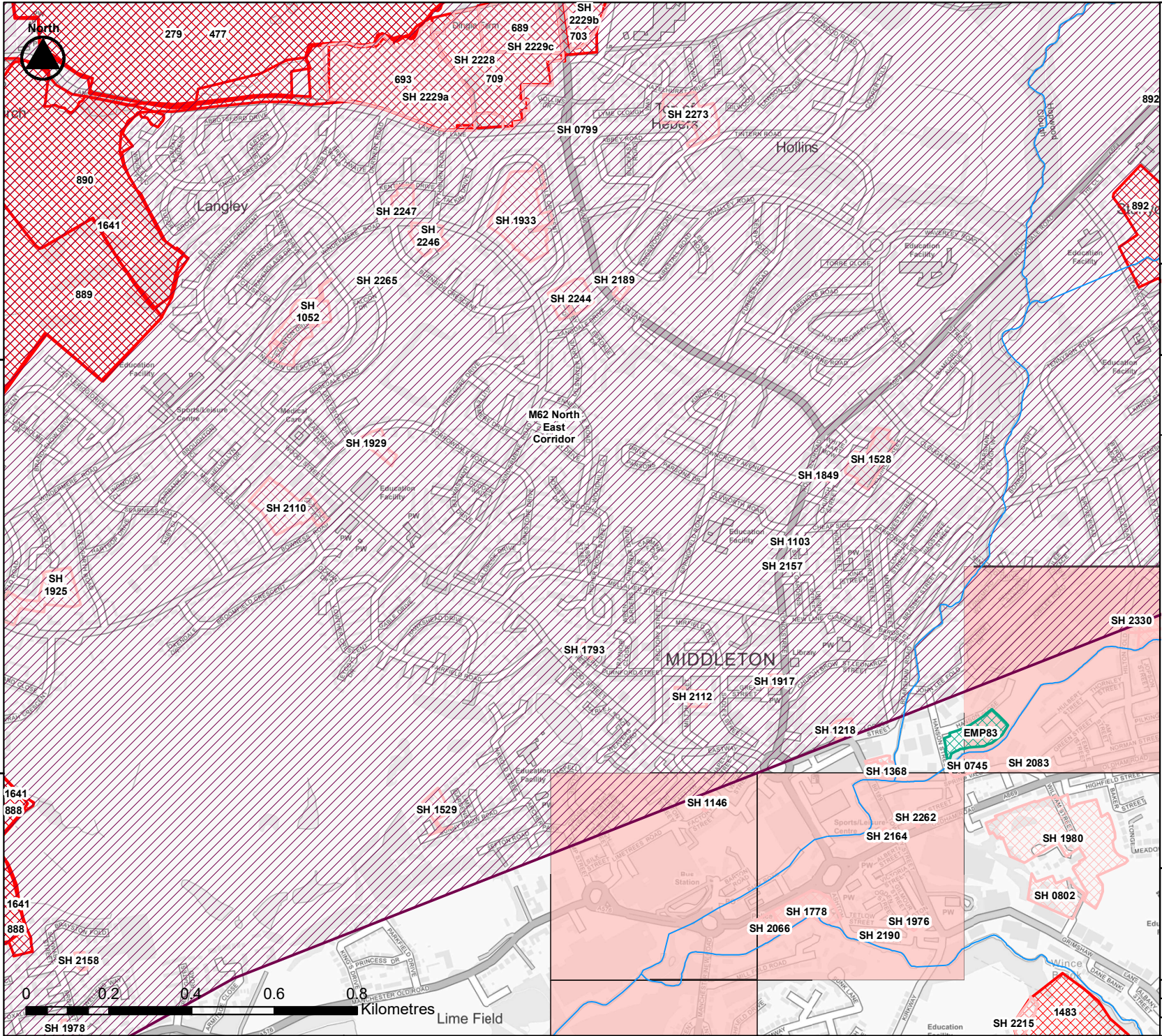


Appendix D

Environment Agency Pluvial Flood Map



Appendix E



LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT

For
ROCHDALE BOROUGH COUNCIL

Please select a data type from the dropdown
menu below that you wish to view:

Historic Flooding

Watercourse

Proposed Development Sites

- GMSF 2019 Strategic Locations
- 2018 GMSF Call for Sites

2018 Baseline Land Supply 2019 GMSF Allocations

- | | |
|------------------------|------------------------|
| Residential | Residential |
| Industry / Warehousing | Industry / Warehousing |
| Offices | Mixed Use |

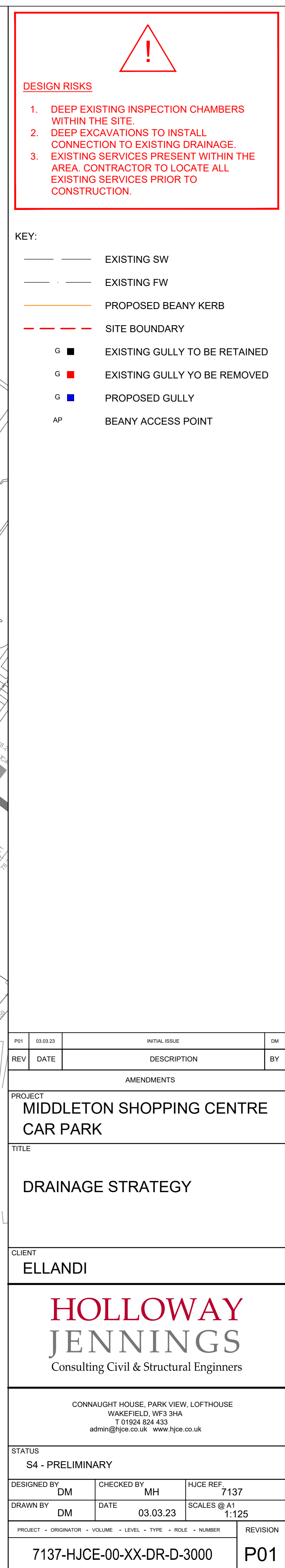
- Historic Flood Map (EA)
- Historical Flooding (Council)
- Surface Water Hotspots (GM SWMP 2013)
- Historic canal overtopping (C&RT)
- Historic canal breaches (C&RT)
- Incidents to sewer flooding (UU)



☒ Show Site
Reference Labels



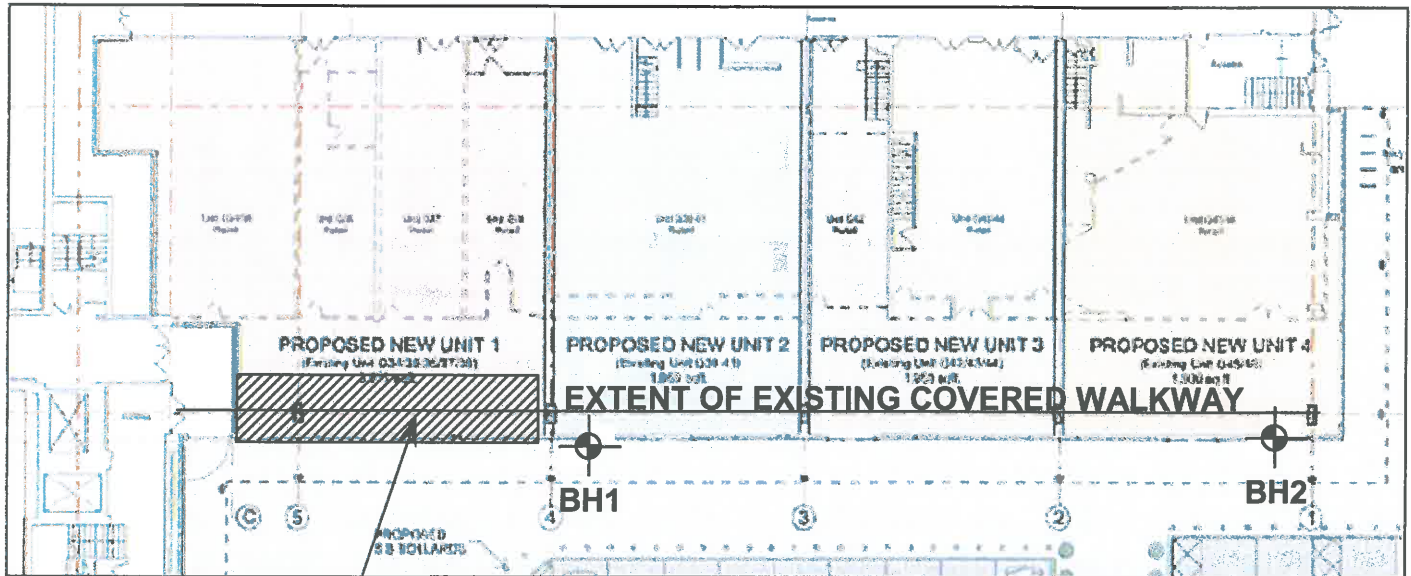
Appendix F



Appendix G

GEOINVESTIGATE Ltd.

OUR REF:G15236	YOUR REF:	SITE PLAN (NOT TO SCALE)
DATE: 30/09/15	LOCATION: Proposed Extension to Middleton Shopping Centre, Middleton M24 4EL	



**AREA OF
PAVEMENT CAFE**

GEOINVESTIGATE Ltd.

Your Ref.

Our Ref.

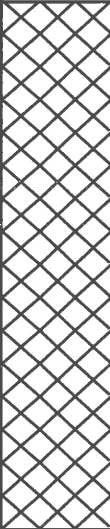
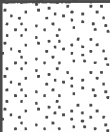
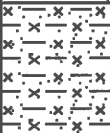
G15236

BH No.1

Sheet No. 1 of 1

Location: Proposed Extension to Middleton Shopping Centre, Middleton M24 4EL

DATE: 30/09/15

Depth (m)	Description of Strata	Thickness	Legend	Gas Well	Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
0.20	TARMAC	200			O	Cv kN/m ²			0.20
1.80	MADE GROUND Loose to medium dense slightly clayey sandy gravel. Gravel is fine to coarse of brick and sandstone. Ash gravel horizon 1.30m to 1.50m	1600			O O C O		1,1,2,2,3,3 N=10 1.00-1.45m		0.50 0.75 1.00 1.25 1.50 1.75
2.20	Very loose brownish orange fine to medium SAND	400			O C		1,0,0,0,0,0 N=0 2.00-2.45m		2.00
2.60	Very soft / very loose brownish grey silty sandy CLAY / clayey silty SAND	400			O				2.25 2.50
5.00	Medium dense brownish grey gravelly SAND with some silty clayey sand / clayey sand horizons Becomes wet from 3.10m Becomes dense from 3.70m Becomes brown coarse slightly gravelly sand from 4.40m Borehole Terminated at 5.00m	2400			O C O O C O O C		2,6,6,8,9,10 N=33 3.00-3.45m 2,8,13,16,11,9 N=49 4.00-4.45m 8,10,15,18,20 N=73 5.00-5.45m	3.00m	2.75 3.00 3.25 3.50 3.75 4.00 4.25 4.50 4.75 5.00

Remarks: Hand excavated to 1.00m

Casing to 2.00m

Dynamic windowless sampling by Terrier Rig to 5.00m

Borehole closed below 3.70m on completion

Key:

 Slotted Pipe
 Plain Pipe
 Bentonite
 Gravel Filter

O Disturbed sample

Cv Shear vane

W Water sample

S Standard Penetration Test

C Cone Penetration Test

BH1

GEOINVESTIGATE Ltd.

Your Ref.

Our Ref.

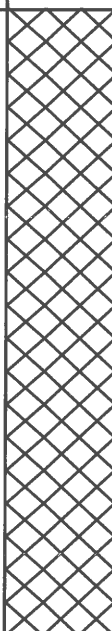
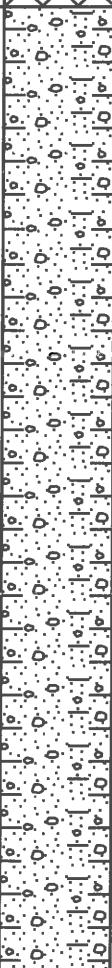
G15236

BH No.2

Sheet No. 1 of 2

Location: Proposed Extension to Middleton Shopping Centre, Middleton M24 4EL

DATE: 30/09/15

Depth (m)	Description of Strata	Thick-ness	Legend	Gas Well	Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
0.20	TARMAC	200			O	Cv kN/m ²			0.20
2.10	MADE GROUND Loose to medium dense slightly clayey sandy gravel. Gravel is fine to coarse of brick and sandstone.	1900			O O C O O C		2,4,4,4,2,3 N=13 1.00-1.45m 1,1,1,1,1,1 N=4 2.00-2.45m		0.50 0.75 1.00 1.25 1.50 1.75 2.00
	Loose orangish brown fine to medium slightly clayey gravelly SAND. Gravel is fine to coarse of sandstone and coal				O				2.25
	Becoming very loose and wet from 2.80m							2.70m	2.50
					O C		1,0,0,0,0,0 N=0 3.00-3.45m		2.75
	Becoming loose from 4.40m								3.00
					O				3.25
		3900							3.50
					O C		2,1,2,2,2,1 N=7 4.00-4.45m		3.75
	Becoming medium to coarse sand from 4.20m and medium dense								4.00
									4.25
					O				4.50
									4.75
	Borehole continued on sheet 2				O C		1,1,2,2,3,4 N=11 5.00-5.45m		5.00

Remarks: Hand excavated to 1.00m

Casing to 2.00m

Dynamic windowless sampling by Terrier Rig to 6.00m

Borehole closed below 3.90m on completion

Key:

 Slotted Pipe

 Plain Pipe

 Bentonite

 Gravel Filter

O Disturbed sample

Cv Shear vane

W Water sample

S Standard Penetration Test

C Cone Penetration Test

BH2

GEOINVESTIGATE Ltd.

Your Ref.

Our Ref.

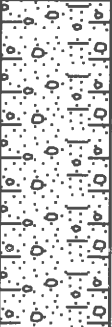
G15236

BH No.2

Sheet No. 2 of 2

Location: Proposed Extension to Middleton Shopping Centre, Middleton M24 4EL

DATE: 30/09/15

Depth (m)	Description of Strata	Thickness	Legend	Gas Well	Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
6.00	Loose orangish brown medium to coarse slightly clayey gravelly SAND. Gravel is fine to coarse of sandstone and coal Very sandy gravel horizon from 5.10m to 5.40m	3900			O	Cv kN/m ²	2,2,2,2,2,2 N=8 6.00-6.45m		5.25 5.50 5.75 6.00
	Borehole Terminated at 6.00m								

Remarks: Hand excavated to 1.00m

Casing to 2.00m

Dynamic windowless sampling by Terrier Rig to 6.00m

Borehole closed below 3.90m on completion

Key:



Slotted Pipe

Plain Pipe

Bentonite

Gravel Filter

O Disturbed sample

Cv Shear vane

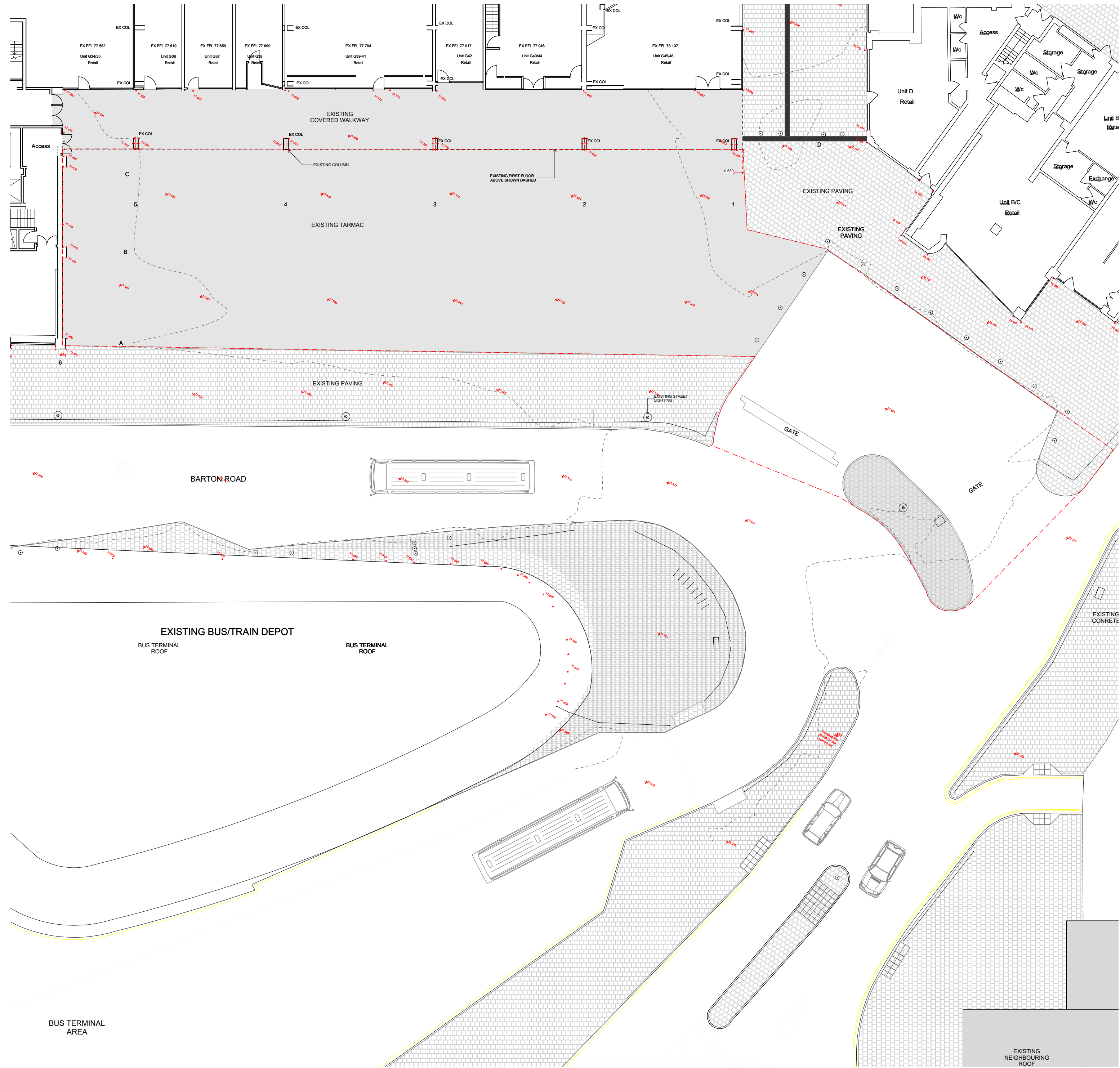
W Water sample

S Standard Penetration Test

C Cone Penetration Test

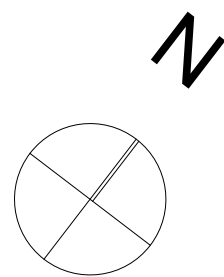
BH2

Appendix H



Issue		
ISSUE DATE	INT.	DESCRIPTION
P1 2023.02.28	MH	ISSUED FOR PLANNING

SCALE 1:200 @A1
0 1 2 3 4 5 6 7 8 9 10



B_master logo_issue_1-01 DD91A1C.jpg

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All survey information used in this drawing was provided by B&B LTD. All areas and measurements to be checked on-site.

PROJECT CLIENT	Ellandi LLP		
PROJECT	MIDDLETON SHOPPING CENTRE Proposed Carpark Scheme		
ADDRESS	Limetrees Road, Middleton, Lancashire M24 4EL		
STATUS	FOR PLANNING		

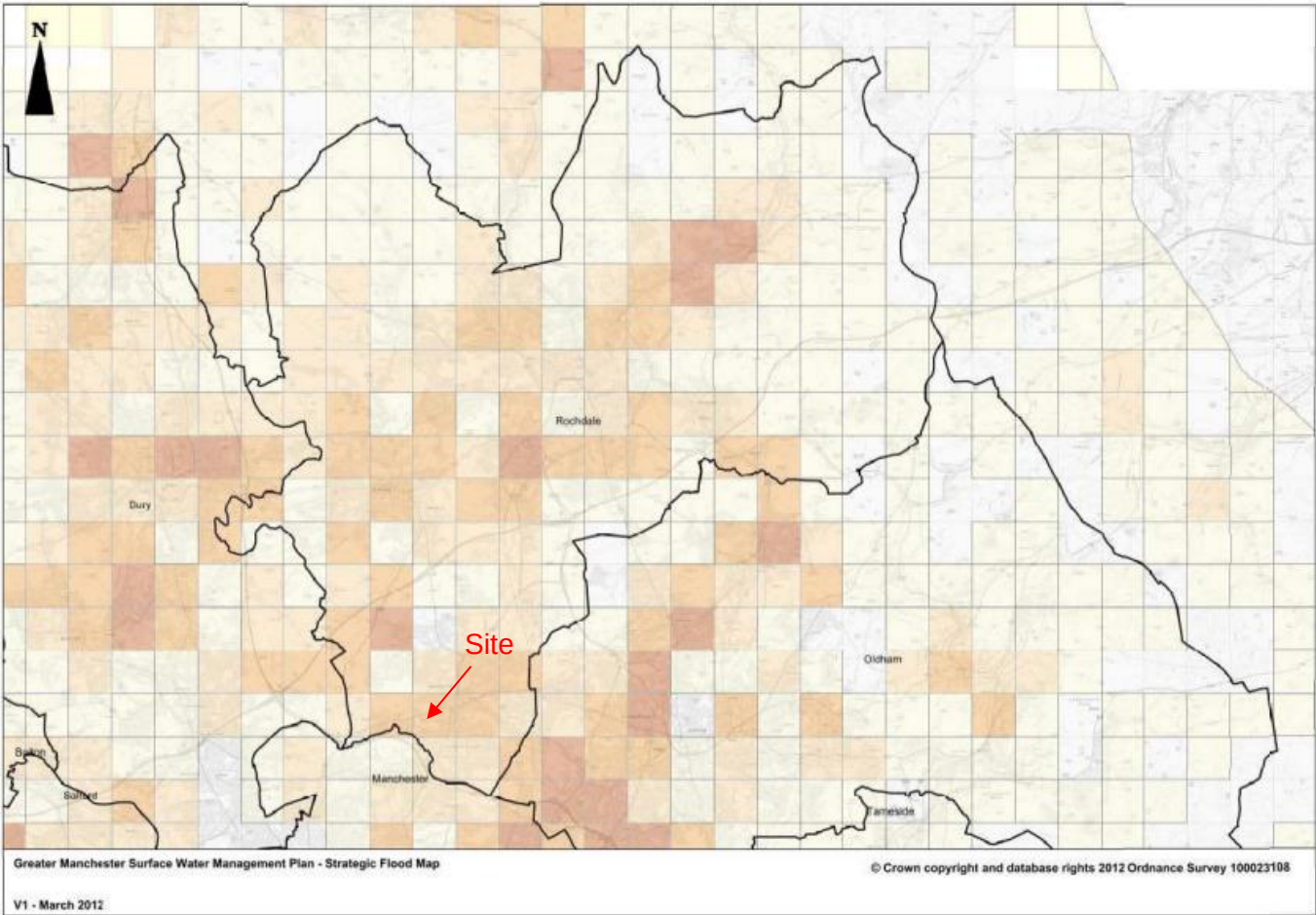
EXISTING CAR PARK LAYOUT PLAN

Figured dimensions take precedence over scale dimensions. Contractors must verify all dimensions on site before commencing any work or making shop drawings.

SCALE @A1	DATE	DRAWN	CHECKED
1:100 @00200	FEB - 23	MH	JF
PROJECT NUMBER	DRAWING NUMBER	ISSUE	
TB_23_2068	P010	P1	

Appendix I

Groundwater Flood Risk Map



Appendix J

