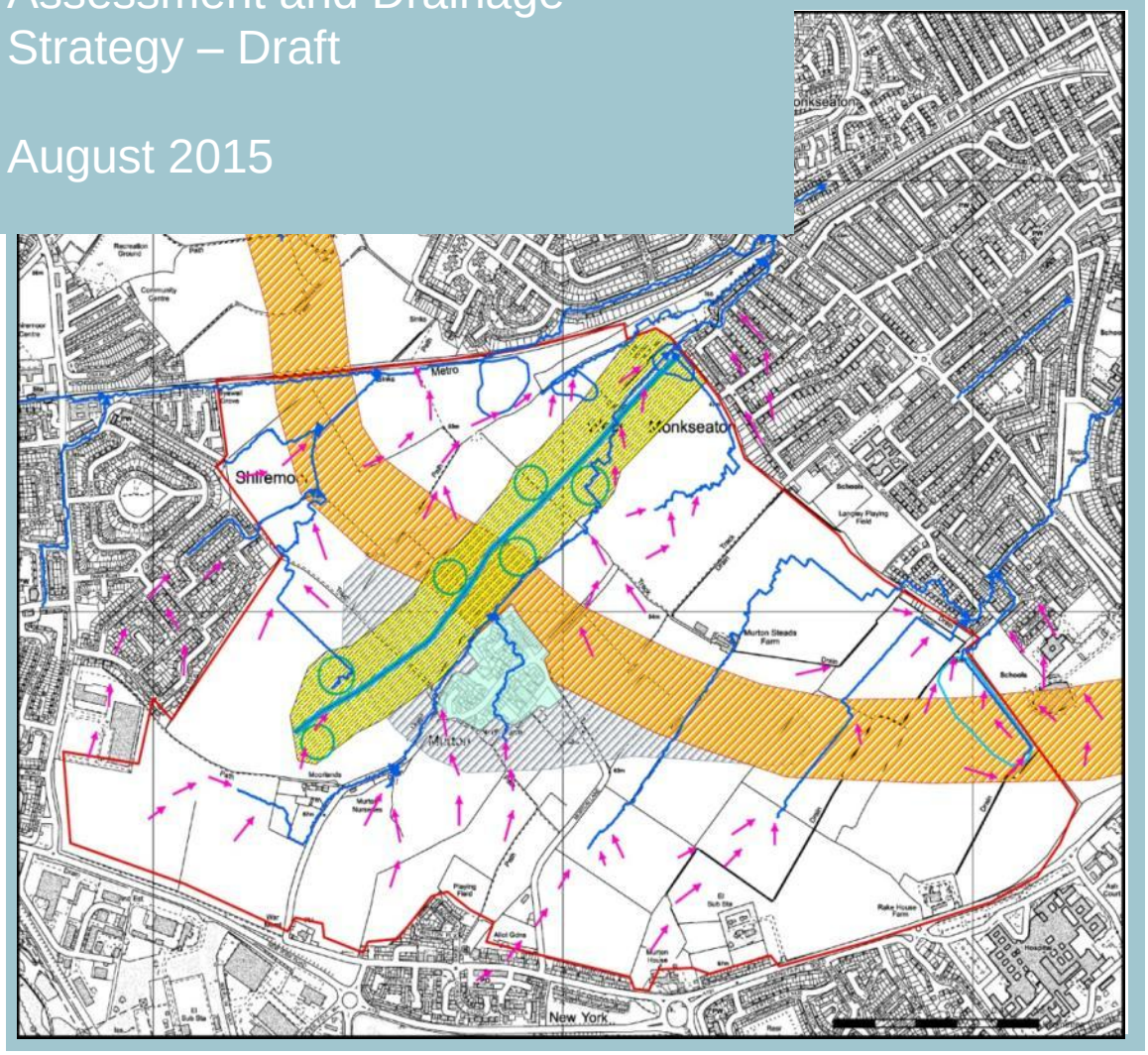
North Tyneside Council

Working in partnership with CAPITA

Murton Gap

Broad Scale Flood Risk Assessment and Drainage Strategy – Draft

August 2015



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Quality Management

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Prepared by	Chris Despins
Checked by	Louise Markose
Authorised by	Louise Markose

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Executive Summary

1.1.1 Murton Gap has been identified in North Tyneside Council's (NTC) 2015 Draft Local Plan as a potential site to accommodate approximately 2,800 - 3,000 homes. Combined with Killingworth Moor the two sites are required to deliver a significant proportion of the overall needs for growth within NTC up to 2032. An agreed masterplan is required to ensure a suitable framework is in place to support future development of each of the sites.

1.1.2 Capita Property & Infrastructure was commissioned by NTC in April 2015 to develop a broad scale flood risk and drainage assessment for the Murton Gap strategic allocation. Known from here on in as "Murton Gap". Note this report does not constitute an NPPF compliant flood risk assessment for planning purposes. It is a strategic assessment to support the allocation of the site in NTC's Local Plan document. If Murton Gap is included in the Local plan it will still require planning permission for any development to occur.

1.1.3 This document provides a summary of the technical analyses carried out. The overall aim of the document is to establish the baseline conditions, evaluate the effects of development and provide evidence that development of Murton Gap can take place whilst not increasing flood risk at the site and surrounding area. A summary of the technical analyses are contained within the main body of this report, with details provided in the supporting appendices.

1.1.4 A review of the Environment Agency (EA) Flood Zone Mapping indicates that Murton Gap is located entirely on land that has a low probability of flooding (Flood Zone 1). The National Planning Policy Framework (NPPF) states that all of the land uses proposed in the Murton Gap masterplan, including those classed as 'Essential Infrastructure' are compatible for development within Flood Zone 1.

1.1.5 The site currently has natural drainage capacity which is in part unmanaged, and extreme rainfall events can contribute to surface water flooding in surrounding areas. Historical flooding records have been recorded by NTC and Northumbria Water Limited (NWL) for properties surrounding Murton Gap. As such the site is located in a Critical Drainage Area (CDA), and the risk of surface water flooding (particularly to surrounding properties) is considered to be high.

1.1.6 To address the existing surface water flood risk for Murton Gap and the surrounding area, NTC is currently developing a flood mitigation scheme for the site that includes the construction of several surface water management ponds, works to the existing ditch network, and repairs to culverts carrying flows discharging from the site.

1.1.7 Development of the drainage strategy took into consideration NTC's planned flood risk mitigation scheme for the site. Given that capacity throughout NTC is restricted through undersized culverts and /or at sewerage infrastructure at capacity, betterment over existing conditions was identified as a key priority to ensure flood risk is appropriately mitigated. As such, surface water attenuation features were sized based on restricting post-developed flows to less-than-Greenfield runoff rates. Where surface water discharge limits of the receiving waterbody / public sewer were unknown, these were limited to not exceed one half of the existing Greenfield ('half Greenfield') runoff rates. The sizing of attenuation features was undertaken based upon managing surface water runoff from the site up to a 1 in 100 year return period (plus climate change) event.

1.1.8 As part of the drainage strategy two options are proposed for Murton Gap. Option One prioritises the use of the existing drainage regime to manage surface water runoff at the site. Option Two proposes the establishment of another green belt, 'Murton Green' to provide a multi-purpose space to accommodate attenuation ponds and other sustainable drainage features, complete with a multi-stage channel for conveyance of surface water to its discharge point at West Monkseaton.

1.1.9 A SuDS suitability assessment was also conducted for Murton Gap. This assessment indicated that there are a number of constraints in the south eastern portion of the site that may make incorporating infiltrating SuDS infeasible or challenging in this area. Conversely, the assessment found that the south western portion of the site, and a small area in the north eastern corner of the site provides much greater opportunities for the implementation of infiltration SuDS. It is recommended that site investigations be conducted to further assess the suitability of incorporating infiltrating SuDS into the Murton Gap masterplan.

1. Introduction

1.1 Scope of assessment

1.1.1 Capita Property and Infrastructure has been appointed by NTC to undertake a broad scale Flood Risk Assessment (FRA) and surface water drainage strategy for Murton Gap.

1.1.2 The objectives of this flood risk assessment and surface water drainage strategy are to:

1. Appraise the potential flood risk to proposed future development in Murton Gap, as well as the potential impact of any development on flood risk elsewhere;

2. Demonstrate that the proposed development can be implemented safely in compliance with national and local policies and guidance;

3. Assess the suitability of implementing Sustainable Drainage Systems (SuDS) and maximise their use throughout Murton Gap; and

4. Demonstrate that development at Murton Gap can occur in combination with a SuDS Management Train[1] to sustainably manage surface water runoff from the proposed development and reduce existing flood risk overall.

1.1.3 This FRA and drainage strategy contains the following information that describes how each of the four over arching objectives have been successfully achieved:

1. Existing and historic flood risk have been assessed using available information from the EA, NTC, and published studies;

2. This report is informed by national and local policies, in particular the NTC Strategic Flood Risk Assessment (SFRA), 2010, North Tyneside Surface Water Management Plan (SWMP), 2012 and the North Tyneside Local Plan Consultation Draft - Draft Flooding Sequential Test, 2015;

3. The suitability of implementing SuDS features was assessed using British Geological Society (BGS) data sets and existing borehole records. SuDS have been promoted throughout the development; and

4. The development layout and sizing and location of sustainable drainage features have been designed so that surface water runoff from the development is managed safely within the site. Furthermore an overall reduction in surface water flood risk to local residents in the surrounding areas through managing the effects of climate change on runoff has been provided.

1.1.4 Note this report does not constitute an NPPF compliant flood risk assessment for planning purposes. It is a strategic assessment to support the allocation of the site in NTC's Local Plan

[1] 'Management train' or 'treatment train' are terms used for an integrated sequence of measures employed in a SuDS scheme which, taken together, control volumes of run off and reduce pollution before discharge.

document. If Murton Gap is included in the Local plan it will still require planning permission for any development to occur.

1.2 Site Overview

1.2.1 Murton Gap is located between the settlements of Shiremoor (to the east) and Monkseaton and Briar Vale, to the west. The strategic allocation is approximately 238 hectares, including Murton Village – a small existing settlement in the approximate centre of the lands.

1.2.2 The northern branch of the Metro forms the northern boundary of the site and the A191 forms the boundary to the south. The village of Shiremoor forms the western boundary, and is comprised of new residential development to the north and a commercial retail property to the south. New residential development forms the eastern boundary of the site, as well as the Monkseaton High School on the south eastern boundary. The site and surrounding area are shown in Figure 1 below.

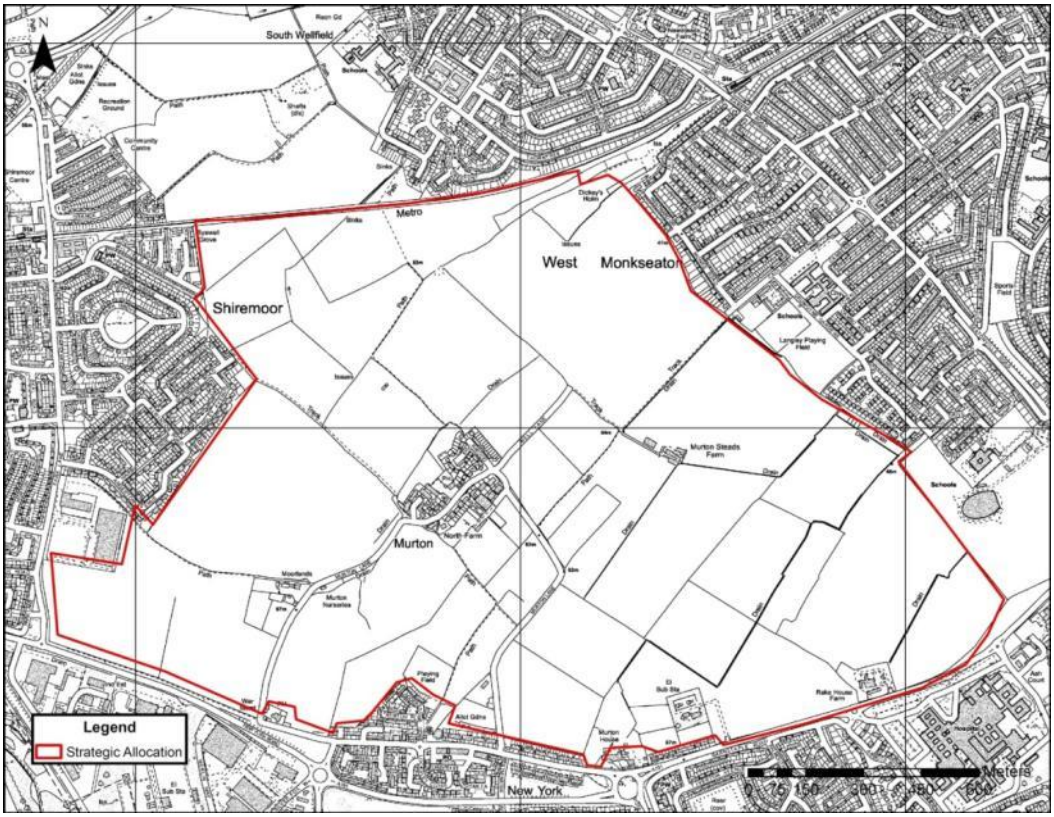


Figure 1: OS Map showing the extent of Murton Gap

1.2.3 Murton Gap is primarily comprised of farmland, with the Murton Steads farmhouse and lands in the eastern portion of the site, Rake House farm to the south and Dickey's Holm to the north. The Village of Murton, lies within the centre of the Murton Gap. The Village of Murton is

accessed via Murton Lane from the A191 to the south. Another small road, Well Lane extends 250m north east of Murton Village. No other major roadways or highways are contained within the lands.

1.2.4 Murton Gap is proposed on land previously identified as safeguarded land, and is planned to contribute approximately 2,800 - 3,000 new homes to the Local Plan. The proposed development on this site would include a mix of housing tenures, types and sizes along with new educational facilities through a new primary and secondary school to support the growth delivered by the proposals.

1.3 Topography and Existing Surface Water Management / Drainage

1.3.1 Murton Gap generally slopes from a high of 72m AOD in the south west corner of the site to a low of 47m AOD in its north eastern extent.

1.3.2 To obtain a greater understanding of how the site currently drains a ‘rolling ball analysis’ was undertaken using available LiDAR data. Rolling ball analysis is used to identify natural flow path determined by topography only. The analysis is completed within QGIS software and uses terrain data from the digital terrain model (DTM). The results of the rolling ball analysis are shown in Figure 2 below.

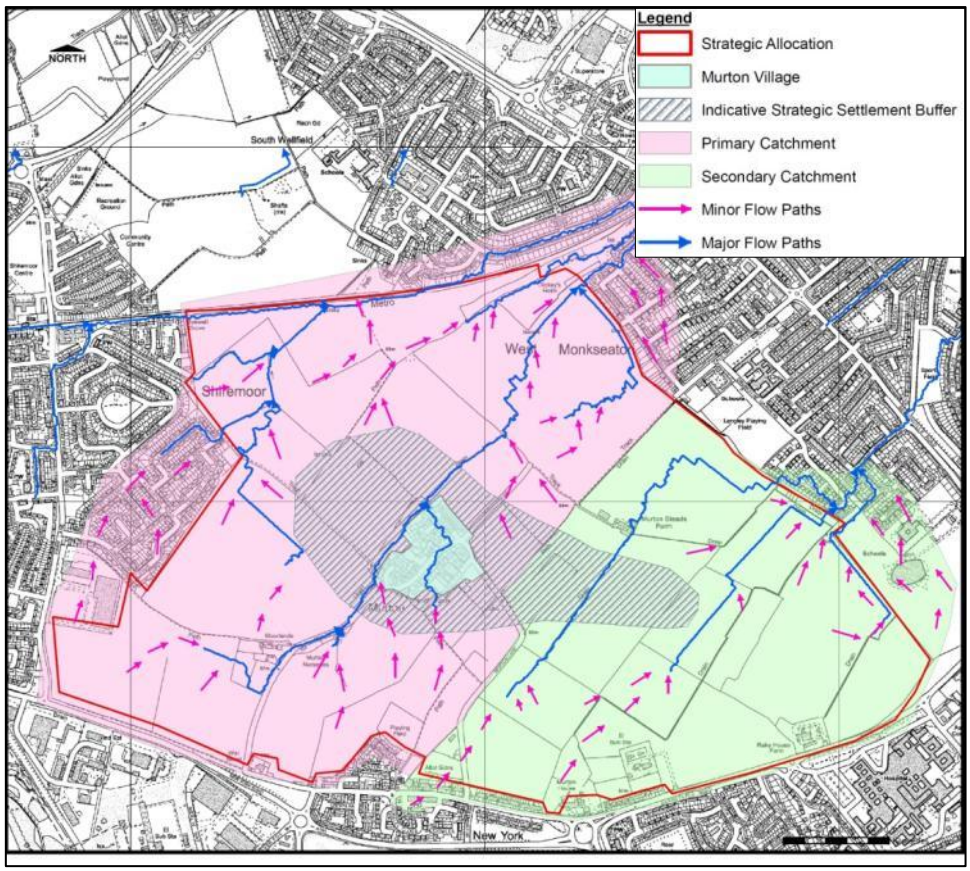


Figure 2: Existing surface water flowpaths at Murton Gap and surrounding lands

1.3.3 As seen in Figure 2 the site is comprised of two catchments. The Primary Catchment (148 ha) conveys flows from south and west towards the north east – to the area of West Monkseaton. The Secondary Catchment (90 ha) drains the south eastern portion of the site towards the Briar Vale area.

1.3.4 There are five major surface water flowpaths within the site. Three of the flowpaths are located within the Secondary Catchment, and convey minor overland flows to Briar Vale. As seen in Figure 2 these flowpaths continue and extend beyond Briar Vale, indicating potential surface water flood risk to these areas should flows not be managed appropriately within the Murton Gap lands.

1.3.5 The most significant flowpath traverses the centre of the site. This flowpath begins in the south western corner of the site, near Murton Nurseries, and flows just north of Murton Village where it leaves the site in the north eastern corner of the site at West Monkseaton. A final flowpath is observed east of Shiremore. This flowpath conveys surface water flows from the western portion of the catchment to the north, where they are then conveyed east along the Metro line, also terminating at West Monkseaton.

1.3.6 The rolling ball analysis indicates that much of the surface water flows are directed through the existing network of ditches that traverse the site. Some surface water flows, however, may not be captured through the informal drainage network. Minor flow routes are predicted exiting

the site in the south western corner and travelling through Shiremore before being returned to the Murton Gap ditch network. Two flowpaths, the major central flowpath and the one to the north along the Metro railway line, place surface water flows close to residential properties and essential infrastructure. These flowpaths would benefit from modifications to ensure that they have sufficient capacity and / or have flows redirected to minimise flood risk to these features.

1.3.7 Drainage infrastructure is in place to manage surface water discharging the site at the two points where flows collect – West Monkseaton in the north east and Briar Vale to the south. A culvert at West Monkseaton conveys flows off site to the surface water drainage network. To the south, the Secondary Catchment drains to a culverted watercourse at Briar Vale that then discharges into a NWL combined sewer at Seatonville Road.

1.3.8 For further details regarding existing site topography, refer to Appendix A.

2. Policy and Guidance

2.1 Flood and Water Management Act, 2010

2.1.1 Combined with the Flood Risk Regulations 2009 ('the Regulations'), (which enact the EU Floods Directive in the England and Wales) the Flood and Water Management Act 2010 ('the Act') places significantly greater responsibility on Local Authorities to manage and lead on local flooding issues. The Act and the Regulations together raise the requirements and targets Local Authorities need to meet, including:

- Playing an active role leading Flood Risk Management;
- Development of Local Flood Risk Management Strategies (LFRMS);
- Implementing requirements of Flood and Water Management legislation;
- Development and implementation of drainage and flooding management strategies; and
- Providing guidance on SuDS systems and surface water management within the local planning process via a statutory consultee role (as of April 2015).

2.1.2 The Act also clarifies three key areas that influence development:

1. *Sustainable drainage (SuDS)* - the Act makes provision for a national standard to be prepared on SuDS (The Non-statutory Technical Standards for Sustainable Drainage Systems, published March 2015). The suitability of SuDS will be assessed by the local authority, in consultation with other applicable flood risk management bodies, primarily the lead local flood authority.
2. *Flood risk management structures* - the Act enables the EA and local authorities to designate structures such as flood defences or embankments owned by third parties for protection if they affect flooding or coastal erosion. A developer or landowner will not be able to alter, remove or replace a designated structure or feature without first obtaining consent from the relevant authority.
3. *Permitted flooding of third party land* **-** The EA and local authorities have the power to carry out work which may cause flooding to third party land where the works are deemed to be in the interest of nature conservation, the preservation of cultural heritage or people's enjoyment of the environment or of cultural heritage.

2.2 National Planning Policy Framework (NPPF), March 2012

2.2.1 In determining an approach for the assessment of flood risk for the proposal there is a need to review the policy context. The National Planning Policy Framework requires that consideration be given to flood risk in the planning process. The National Planning Policy Framework was issued in March 2012 and outlines the national policy position on development and flood risk assessment.

2.2.2 The Framework states that the appropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk. Where development is necessary in flood risk areas, it can be permitted provided it is made safe without increasing flood risk elsewhere.

2.2.3 The essence of NPPF is that:

- Local Plans should be supported by Strategic Flood Risk Assessment and develop policies to manage flood risk from all sources, taking advice from the Environment Agency and other relevant flood risk management bodies, such as lead local flood authorities and internal drainage boards;
- Polices in development plans should outline the consideration, which will be given to flooding issues, recognising the uncertainties that are inherent in the prediction of flooding and that flood risk is expected to increase as a result of climate change;
- Planning authorities should apply the precautionary principle to the issue of flood risk, using a risk-based search sequence to avoid such risk where possible and managing it elsewhere;
- The vulnerability of a proposed land use should be considered when assessing flood risk;
- Opportunities offered by new developments should be used to reduce the causes and impacts of flooding;
- Planning authorities should recognise the importance of functional floodplains, where water flows or is held at times of flood, and avoid inappropriate development on undeveloped and undefended floodplains; and
- Development is based on the concept of Flood Risk Reduction, particularly in circumstances where development has been sanctioned on the basis of the "Exception Test".

2.3 Planning Practice Guidance Flood Risk and Coastal Change, April 2015

2.3.1 The accompanying practice guidance to the NPPF provides additional guidance to local planning authorities to ensure the effective implementation of the planning policy set out in the National Planning Policy Framework on development in areas at risk of flooding.

2.3.2 The practice guidance provides supporting information on:

- The application of the sequential approach and Sequential and Exception Tests;
- Measures to reduce flood risk to acceptable levels;
- How to manage residual risks; and
- Guidance on how to take climate change into account.

2.3.3 The April 2015 update to the practice guidance provides additional guidance on SuDS, including:

- The importance of SuDS;
- When SuDS should be considered;
- The SuDS discharge hierarchy;
- Factors a local authority will address when considering SuDS as part of a planning application;
- When SuDS are inappropriate and relevant flood risk consultees;
- Applicability of Defra's Non-statutory Technical Standards for Sustainable Drainage Systems;
- Design and construction cost considerations;
- Operation and maintenance considerations; and

- Where to go for further SuDS advice.

2.3.4 As part of the April 2015 update, the practice guidance provides details on the parties responsible for assessing the suitability of SuDS practices. As per paragraph 084 from the practice guidance:

> *The decision on whether a sustainable drainage system would be inappropriate in relation to a particular development proposal is a matter of judgement for the local planning authority. In making this judgement the local planning authority will seek advice from the relevant flood risk management bodies, principally the lead local flood authority, including on what sort of sustainable drainage system they would consider to be reasonably practicable.*

2.4 Non-statutory Technical Standards for Sustainable Drainage Systems, March 2015

2.4.1 This document, published by the Department for Environment, Food and Rural Affairs, sets out non-statutory technical standards for sustainable drainage systems. The non-statutory technical standards should be used in conjunction with the National Planning Policy Framework and Planning Practice Guidance.

2.4.2 Non-statutory technical standards are provided for the following items:

- Flood risk outside the development;
- Peak flow control;
- Volume control;
- Flood risk within the development;
- Structural integrity;
- Designing for maintenance considerations; and
- Construction.

2.5 North Tyneside Council Level 1 Strategic Flood Risk Assessment, July 2010

2.5.1 A Level 1 Strategic Flood Risk Assessment (SFRA) was produced on behalf of NTC to aid in the preparation of a Local Development Framework (LDF) and Local Development Documents (LDDs).

2.5.2 The objectives of the SFRA were predominantly informed by the requirements of Planning Policy Statement 25, which required that decision makers involved in the planning process consider regional and local flood risk issues when planning development.

2.5.3 broad level of assessment of flood risk was conducted across NTC as part of the SFRA. The following risks were identified:

1. Fluvial and Tidal flooding – the SFRA indicates that Murton Gap is at low risk of fluvial / tidal flooding.
2. Surface water and sewer flooding – Surface water flood risk were identified in two preliminary Critical Drainage Areas – Benton and Brierdene / Whitley Bay. The SFRA states that there is significant risk of surface water flooding from greenfield land in the Brierdene / Whitley Bay (which contains Murton Gap).

3. Groundwater Flooding – The SFRA indicates there are no flood defences along the River Tyne through North Tyneside to elevate the river level above the floodplain. It concludes that it is unlikely that alluvial groundwater flooding will occur. The SFRA recommends that the risk of groundwater flooding be investigated at a site-specific FRA level.
4. Infrastructure Failure from Artificial Sources - there are no large raised reservoirs directly located within the boundaries of NTC or surrounding Councils. As such, risk of flooding from large artificial sources is considered to be low. There may be smaller reservoirs not assessed as part of the SFRA, and as such FRAs should assess the residual risk associated with them if they are located within the vicinity of the development.

2.5.4 The SFRA made the following comments and recommendations pertaining to Murton Gap the and surrounding area:

> *Whilst [Murton Gap] is not identified at flood risk within the fluvial Flood Zones (2, 3a or 3b) it is situated upstream of areas at high risk of surface water and sewer flooding. Currently the Greenfield land has a natural drainage capacity but during extreme rainfall events can contribute to surface water flooding downstream, as noticeable by key flow paths. These flow paths also correlate with historically flooded properties identified by NTC and NWL.*
>
> *Proposed development sites like this should be flagged during the Sequential Test sieving process and avoided as they could significantly increase the amount of surface water runoff in the area by reverting Greenfield land to Brownfield and also place further pressure of the current drainage area.*
>
> *If proposed development sites like these are allocated they should follow the same stringent recommendations as if they were at risk from fluvial or tidal flooding. Site-specific FRAs will be required for each site but a strategic drainage impact assessment will also be needed for the wider area. SuDs should also be considered at the earliest possible stage.*

2.6 North Tyneside Preliminary Flood Risk Assessment (PFRA), 2011

2.6.1 The PFRA produced in 2011 on behalf of NTC is a key document informing the preparation of future Local Flood Risk Management Strategies as required by the Flood and Water Management Act 2010.

2.6.2 Future flood risk within NTC was assessed by looking at the borough as a whole and assessing potential risk areas based on a variety of local flooding sources. Based on the EA's National Flood Map for Surface Water (FMfSW), approximately 2,500 properties are potentially at risk of flooding to a depth of 0.3 metres in a 1 in 200 year rainfall event in the North Tyneside area.

2.7 North Tyneside Surface Water Management Plan (SWMP), 2012

2.7.1 The North Tyneside Surface Water Management Plan (SWMP) was developed to provide flood risk management strategies as required by the Flood and Water Management Act 2010. The

plan was produced by the Council in its newly designated role as Lead Local Flood Authority (LLFA) under the Flood and Water Management Act.

2.7.2 The SWMP is intended to provide an understanding of the causes of surface water flooding and agree a preferred strategy for the management of surface water flood risk. The report focuses upon flooding from sewers, drains, groundwater, and runoff from land, ordinary watercourses and ditches that occurs as a result of heavy rainfall.

2.7.3 The SWMP built upon the findings of the Level 1 SFRA with respect to surface water flood risk. In particular, the SWMP refined the initial Critical Drainage Areas (CDAs) identified in the Level 1 SFRA. A pluvial model was created for NTC to assess, in more detail, the areas and the number of properties at risk of surface water flooding over a range of rainfall events. CDAs were identified using pluvial modelling based on the 1 in 75 year return period event.

2.8 North Tyneside Local Flood Risk Management Strategy, 2014

2.8.1 The Local Flood Risk Management Strategy is a tool aimed at helping understand and manage local flood risk within NTC. Local Flood Risk is defined as surface water flooding, ordinary watercourse flooding and groundwater flooding. This area of responsibility is defined by the Flood and Water Management Act.

2.8.2 One of the key purposes of the strategy is to highlight the steps that are to be taken to ensure better co-operation between organisations involved in flood risk management and better communication with the public about those risks and what can be done.

2.9 North Tyneside Local Plan Consultation Draft - Draft Flooding Sequential Test, 2015

2.9.1 This report sets out the Sequential Test and Exception Test of flood risk in NTC specifically focussed on the proposed development sites that have been allocated in the Local Plan Consultation Draft 2015 (LPCD).

2.9.2 For Murton Gap, the report states the following:

> *The fields that surround Murton have been identified as a Critical Drainage Area (CDA). Surface water flooding or the combination between watercourses and surface water drainage is the greatest risk with a number of sites situated on direct surface water flow paths, or within flood zones and Critical Drainage Areas (CDAs). Large dense developments could have significant implications on current risk to the surrounding community and further downstream if runoff is not controlled or current flood risk is not reduced. As outlined in the Infrastructure Delivery Plan (IDP), there are schemes planned to reduce flood risk in this area at present. Further details of these schemes can be accessed from the IDP. Surface water susceptibility zones are not specifically included in the Sequential Test, however it was recommended in the North Tyneside Strategic Flood Risk Assessment (SFRA) a suite of flood maps should be prepared. As part of the Sustainability Appraisal (SA), site surface water flood risk has been taken into account.*

Whilst Murton is not identified at flood risk within the fluvial Flood Zones (2, 3a or 3b) they are situated upstream of areas at high risk of surface water and sewer flooding, and it is therefore important to thoroughly understand surface water flows and site drainage. Currently the site has natural drainage capacity which is unmanaged, and extreme rainfall events can contribute to surface water flooding downstream. These flow paths also correlate with historically flooded properties identified by North Tyneside Council and Northumbria Water Limited. With this in mind, a Level 2 FRA would be required for the sites to ensure that opportunities for flood reduction are delivered.

2.10 Local Plan Consultation Draft 2015 (LPCD)

2.10.1 The Local Plan Consultation Draft 2015 sets out the preferred policies and proposals that the Council propose to guide planning decisions and establish the framework for the sustainable growth and development of NTC up to 2032. The consultation draft covers a range of matters including the number of new homes that are needed and where they should be located; the amount and proposed location of new employment land; protection and improvement of important open areas and provision of new ones; provision of new infrastructure and improvement of town centres and community facilities in the Borough.

2.10.2 The Local Plan Consultation Draft 2015 contains a series of policies which are relevant to this report:

Policy S/1.1 sets out the spatial policy to help direct development to the most sustainable locations. It sets out development priorities, such as employment development, housing, retail, leisure, tourism and cultural facilities to be built within the main urban area.

Policy S/5.2 sets out the provision of land for employment development across the plan period, and how the employment sites set out in the plan have been selected.

Policy S/7.3 sets out the distribution of potential development sites across North Tyneside and outlines the process of the selection for each of the sites that are outlined. This policy sets out a breakdown of the potential development sites into 'Strategic Sub Areas', which are outlined as the Main Urban Area, Wallsend, North Shields, Coastal Areas and North West Communities.

Policy S/6.1 sets out a strategy to pursue growth and regeneration of the existing town centres and retail provision

2.10.3 The two main flood related policies in the Local Plan Consultation Draft are DM 8.12 Development and Flood Risk and DM 10.10 Sustainable Drainage.

2.11 The SuDS Manual, CIRIA, 2007

2.11.1 This guidance provides best practice on planning, design, construction, operation and maintenance of Sustainable Drainage Systems (SuDS) to facilitate their effective implementation within developments.

2.11.2 The guidance supersedes previous general guidance on SuDS and addresses landscaping, biodiversity issues, public perception and community integration as well as water quality treatment and sustainable flood risk management. The output is based on results contained in the Environment Agency R&D Report SCO20114/2.

2.11.3 The SuDS Manual aims to provide comprehensive advice on the implementation of sustainable drainage techniques in the UK. It provides guidance on:

- Initial planning;
- Design through to construction;
- The management of SuDS in the context of the current regulatory framework; and
- Advice on landscaping, waste management, cost, and community engagement.

2.11.4 The SuDS Manual has been used to provide the necessary design guidance for the surface water drainage strategy.

2.12 CIRIA C635 Designing for Exceedance in Urban Drainage: Good Practice, 2006

2.12.1 This document provides best practice advice for the design and management of urban sewerage and drainage systems to reduce the impacts from drainage exceedance. Information on the effective design of underground systems and overland flood conveyance is included as well as advice on risk assessment procedures and planning to reduce the impacts that extreme events may have on people and property within the surrounding area.

2.12.2 The broad objective is to improve the engineers, planners and designers' appreciation of the risks associated with urban drainage systems and their understanding of how these risks may be mitigated. The guidance is relevant to areas drained by piped systems or SuDS.

3. Existing and Historical Flood Risk

3.1 Fluvial (Main River) and Tidal Flood Risk

3.1.1 A review of the EA's Flood Map for Planning (Rivers and Sea) indicates that all of Murton Gap is located in Flood Zone 1. This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%). The EA Flood Zone extents for Murton Gap and the surrounding areas are illustrated in Figures 3 below.

Figure 3: EA Main River Flood Zones

3.1.2 Tidal flooding occurs when a high astronomical tide and storm (tidal surge) exceeds the level of coastal land or coastal flood defences. Tidal flooding can also be caused by 'tide locking' of rivers or estuaries. Tide locking prevents a river from discharging into the sea, causing 'backing up' and resulting in tidal / fluvial flooding.

3.1.3 EA indicative Flood Map for Planning (Rivers and Sea) indicates that the site is at low risk of tidal flooding.

3.1.4 There are no historic records of fluvial (main river) or tidal flooding within Murton Gap.

3.1.5 Murton Gap are considered to be at low risk of fluvial and tidal flooding.

3.2 Surface Water and Sewer Flood Risk

3.2.1 Surface water flooding happens when rainwater does not drain away through the normal drainage systems or soak into the ground, but lies on or flows over the ground instead.

3.2.2 Figure 4 shows the risk of flooding from surface water (the EA's updated flood map for surface water (uFMfSW)) on Murton Gap and surrounding areas.

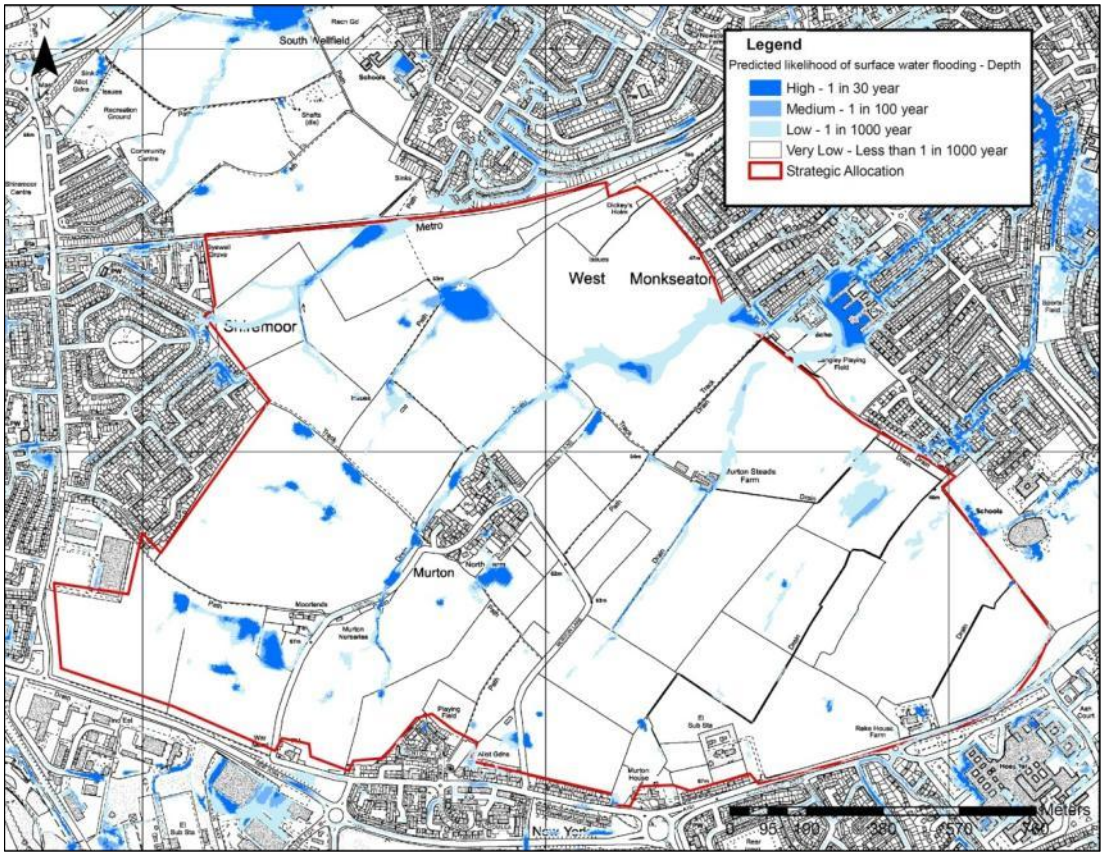


Figure 4: EA Updated flood map for surface water

3.2.3 As seen in Figure 4 there are several areas where surface water ponding is predicted within the site. In the south western portion of the site, ponding is predicted along parts of the existing ditch network conveying surface water from west to east towards Murton Lane. To the north, surface water ponding is also noted along ditches draining surface water towards the northern boundary of the site, where ponding can be seen along the Metro rail corridor. A larger area of ponding is observed north of Murton Village. This ponding is located in small depression at the junction of several ditches.

3.2.4 Small areas of surface water ponding are also predicted along the ditch network conveying flows from the centre of the site (north east of Murton Village) towards the north eastern boundary of the site. The predicted flood extents indicate that the existing capacity of these

ditches are insufficient to convey flows under extreme events associated with conditions categorised as a low risk of surface water flooding (between a 1 in 1000 (0.1%) and 1 in 100 (1%) return period event). Minor areas of surface water flooding are predicted in the south eastern portion of the site, with ponded locations primarily corresponding to the ditch network.

3.2.5 Of note from Figure 4 is that there are several existing surface water flowpaths that are contributing to wider surface water flooding issues at properties and structures surrounding Murton Gap. One surface water flowpaths can be seen extending from the centre of the site to residential properties along the north eastern boundary of the site. This flowpath may contribute to surface water flood risk for residential properties near Monks Road and Drumoyne Gardens. Several smaller flowpaths are observed in the Murton Steads Farm area in Figure 4, which may contribute to ponding in the Briar Vale area. A final major flowpath is observed in the north of Murton Gap, where ponding is predicted along the Metro railway line.

3.2.6 There is NWL sewerage infrastructure throughout Murton Gap, including combined sewer lines, water distribution and a large combined sewer storage tank located in the north western corner of the site. Refer to drainage network plans in Appendix A for further details.

3.2.7 Widespread surface water flooding in North Tyneside was experienced following exceptional, high-intensity levels of rainfall, which fell on the 28th June 2012 and 25th September 2012. The amount of surface water runoff was exacerbated by already saturated ground conditions caused by the prolonged periods of precipitation throughout the summer of 2012. Areas flooded from the 28th June event are shown in Figure 5 below.

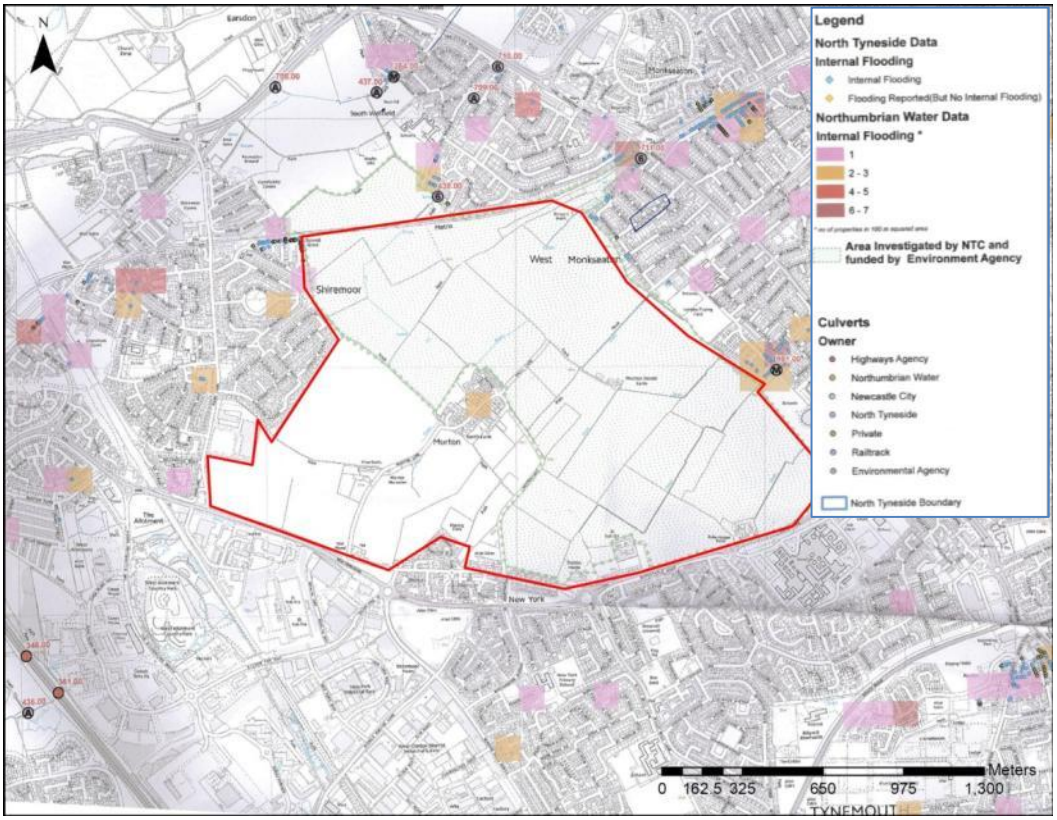


Figure 5: Areas flooded on June 28th 2012

3.2.8 Many of the flooded areas in Figure 5 correspond with the EA's updated flood map for surface water (Figure 4). Several grids, each comprised of 2-3 internal flooded properties can be seen in the Briar Vale area, along the eastern boundary of Murton Gap. These flooded locations correspond with ponding identified on the uFMfSW. To the north east, internal flooding was also recorded along Monks Road, also in line with the uFMfSW predicted flooded areas. Additional flooding, not predicted on the uFMfSM is observed in the north eastern corner of Murton Gap. This flooding was likely due to capacity constraints of the existing culvert at West Monkseaton and downstream surface water drainage network. This resulted in a number of properties being flooded in the area surrounding Earsdon Road and the West Monkseaton Metro station.

3.2.9 The North Tyneside 2012 Surface Water Management Plan states that surface water flooding incidents have also been recorded in the West Monkseaton area from rainfall events in 2005 and 2009. Residential properties on Briar Vale were also impacted in 20052.

3.2.10 Given the historical records of surface water flooding in the area, a majority of Murton Gap have been identified as lying within the West Monkseaton CDA. A CDA is an area that has critical drainage problems and which has been notified to the local planning authority as such by the EA. For further details refer to Figure 6 below. The CDAs were identified as part of the SWMP that was undertaken for NTC in 2012. All CDAs for NTC are provided in Appendix B.

[2]North Tyneside Surface Water Management Plan, 2012.

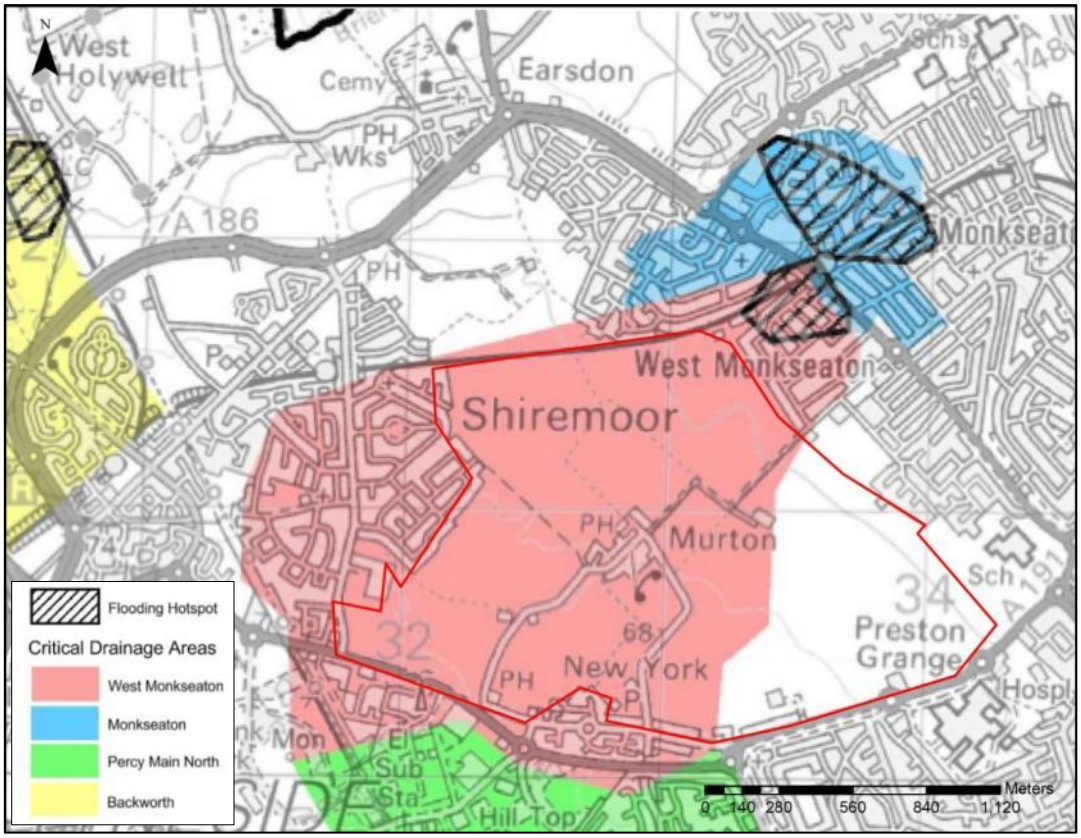


Figure 6: Flooding hotspots and associated critical drainage areas[3]

3.2.11 As a result of the 2012 flooding, NTC has initiated a number of flood alleviation works throughout the Council. Approximately two thirds of Murton Gap fall within one of the flood alleviation works areas. For further details regarding the works planned for Murton Gap and surrounding area, please refer to the Drainage Strategy section.

3.2.12 Given the surface water ponding predicted in the EA's uFMfSW and historical flooding records the existing site is considered to be at moderate risk from surface water flooding. It is evident that several existing surface water flowpaths are predicted to cause flooding at adjoining structures and properties – in particular the West Monkseaton Metro station, and residential properties along the eastern boundary, including Westward Green / Monks Road and Briar Vale.

3.2.13 As the site does contribute to wider catchment surface water flooding issues it is strongly recommended that the post-development run-off should be limited to a reduced rate as practical.

3

3.3 Groundwater Flood Risk

3.3.1 Groundwater flooding is defined as the emergence of groundwater at the ground surface, or the rising of groundwater into man-made ground, under conditions where the normal range of groundwater levels is exceeded. Groundwater flooding is most likely to occur in low-lying areas underlain by permeable rocks (aquifers).

3.3.2 An assessment of groundwater flooding susceptibility undertaken for NTC in 2011 identified that parts of Murton Gap are at risk of groundwater flooding. Refer to Figure 7 below for further details (the full figure is available in Appendix B).

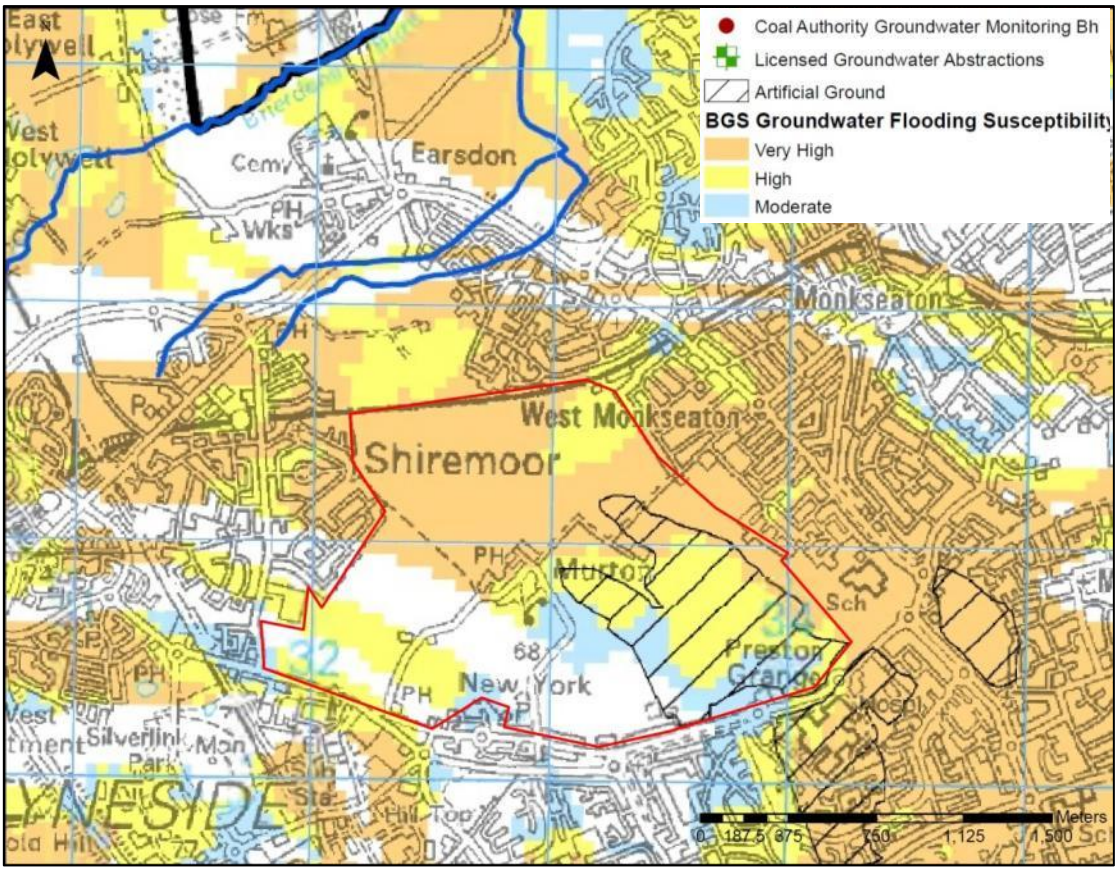


Figure 7: Groundwater flooding susceptibility

3.3.3 The predicted flood susceptibility ratings are from a BGS data set based upon geological and hydrogeological conditions. The BGS data set suggests that susceptibility is mostly associated with the superficial deposits (Glacial Till) as opposed to bedrock geology (largely Pennine Middle Coal Formation).

3.3.4 The 2011 groundwater flooding susceptibility study noted that there was no water level data as part of the study, and as such there is a need to validate the data set.

3.3.5 To provide a high level validation of groundwater flood risk several historical borehole records within the Murton Gap site were assessed to review historical depth to groundwater levels:

1. A borehole approximately 500m south of the north western boundary (BGS Reference: NZ37SW626) did not strike water through the course of its 10.1m depth.
2. A borehole 40m southeast of Monks Road, along the northeastern boundary of the site (BGS Reference: NZ37SW656) did not encounter groundwater to a 30m depth (though seepage from clays was observed)
3. A borehole near the south eastern boundary of the site (BGS Reference: NZ37SW267) did not report striking water in the 21m borehole record.
4. A borehole 100m east of the Boundary Mills retail building along the south western boundary of the site (BGS Reference: NZ37SW621) did not encounter groundwater during its 9.6m depth.

3.3.6 The 2012 North Tyneside Surface Water Management Plan states that no groundwater flooding incidents have been reported to the EA or NTC. Areas of historical surface water flooding have been provided, by the EA and NTC, but it's not known if any of these were caused by groundwater flooding.

3.3.7 The BGS groundwater flooding susceptibility data set indicates that a majority of Murton Gap are at a high to very high susceptibility to groundwater flooding. A review of several boreholes spread across the Murton Gap lands, however, did not indicate that groundwater levels were high in the area. Based upon the inconclusive data available, groundwater flood risk is considered to be low to moderate for the site. It is recommended that the risk of groundwater flooding be investigated at a site-specific FRA level.

3.4 Artificial Sources of Flood Risk

3.4.1 Artificial sources of flooding include reservoirs, canals, lakes and mining abstraction. A review of the EA Reservoir Inundation Maps indicates that the site is not located within an area at risk from reservoir flooding.

3.4.2 Other artificial sources of flooding include canals, lakes or mining abstractions. Murton Gap are not located near any of these items, and as such is not at risk from these sources.

4. Development Proposals

4.1 Overview

4.1.1 Murton Gap strategic allocation is proposed on land previously identified as safeguarded land, and would contribute approximately 2,800 - 3,000 new homes to the Local Plan. The master plan for the site (from the North Tyneside Local Plan Consultation Draft 2015) proposes that the site will be used to provide a mix of housing tenures, types and sizes alongside new educational facilities through a new primary and secondary school to support the growth delivered by the proposals. An indicative masterplan is shown in Figure 8 below.

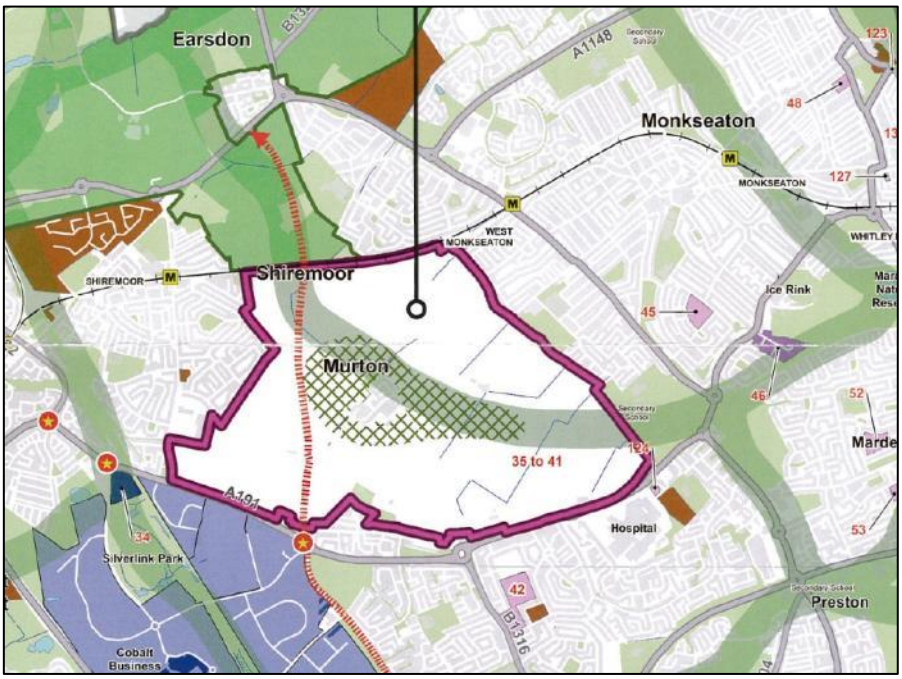


Figure 8: Section of master plan centred on the Murton Gap site

4.1.2 The indicative master plan proposes the establishment of a buffer around Murton Village to ensure that the character of the village is not significantly impacted. Plans also include access to open space through the establishment of a green belt extending across the site, with links to surrounding areas.

4.1.3 Draft development proposals / layouts were not available as part of this assessment. As such the following discussion will centre on the proposed master plan and its development mix.

4.2 Development Types & Vulnerability Classification

4.2.1 Murton Gap will include a mix of some or all of the following property types:

- New residential homes;
- New educational facilities (primary and secondary schools);
- Public open space / green belt;
- Link roads and other essential infrastructure; and
- Employment land.

4.2.2 As the proposed master plan includes a number of land use types, this results in more than one vulnerability classification for the site. The vulnerability for each potential land use within the site is shown in Table 1.

Table 1: Vulnerability Classification for site development in accordance with Table 2 of the Planning Practice Guidance

Land Use Type	Vulnerability Classification
Residential	More Vulnerable
Educational establishments	More Vulnerable
Public open space	Water-Compatible Development
Transport Infrastructure	Essential Infrastructure
Employment lands	Less Vulnerable

4.3 Suitability for Development

4.3.1 The National Planning Policy Framework states that all of the land uses proposed in the Murton Gap master plan, including those classed as 'Essential Infrastructure' are compatible for development within Flood Zone 1.

4.3.2 As the Murton Gap strategic allocation is located within a CDA and contributes to wider surface water flooding issues, additional consideration to development was provided through the North Tyneside Local Plan Consultation Draft - Draft Flooding Sequential Test, January 2015. Further details regarding the Sequential Test are provided below.

4.4 Sequential Test

4.4.1 As the Murton Gap lands are all classified as Flood Zone 1, undertaking the Sequential Test would not normally be required under the NPPF. However, the North Tyneside SFRA specified that whilst surface water susceptibility zones are not specifically included within the Sequential Test, it is recommended that a sieving process be undertaken to development sites identified at risk. The report recommended that land around Murton be included in this process.

4.4.2 The SFRA further specified that if proposed development sites like Murton are allocated they should follow the same stringent recommendations as if they were at risk from fluvial or tidal flooding. Site-specific FRAs will be required for each site but a strategic drainage impact

assessment will also be needed for the wider area. SUDs should also be considered at the earliest possible stage.

4.4.3 The North Tyneside Draft Flooding Sequential Test for the Murton lands specified that the primary means of mitigating flood risk for the site would be through site design to avoid the areas susceptible to surface water flooding. It recommends avoiding construction of housing in high risk areas of the site (approximately 25% at risk). The remainder of the site could be substituted with less vulnerable uses, such as new public open space. This area could be used for the installation of SuDS feature to attenuate surface water on site, before it is discharged.

4.4.4 The North Tyneside Draft Sequential Test concluded that overall whilst there are some flood issues, the level of development forecast for the site has taken into account the level and area to substitute less vulnerable uses. It is likely that this site would pass the Exception Test. As such, taking a sequential approach to development within the Murton Gap lands is recommended to ensure compliance with the Draft Sequential Test. Further details regarding proposed flood risk mitigation measures for the site are provided in the following sections.

5. Flood Risk Mitigation and Surface Water Drainage Strategy

5.1 Overview

5.1.1 As previously discussed, the site currently has natural drainage capacity which is in part unmanaged, and extreme rainfall events can contribute to surface water flooding in surrounding areas downstream. These flow paths correlate with the findings of the rolling ball analysis and historically flooded properties identified by NTC and NWL.

5.1.2 Drainage infrastructure is in place to manage surface water discharging the site at the two points where flows collect – West Monkseaton in the north east and Briar Vale to the south. A culvert at West Monkseaton conveys flows off site to the surface water drainage network. To the south, the Secondary Catchment drains to a culverted watercourse at Briar Vale that then discharges into a NWL combined sewer at Seatonville Road.

5.1.3 NTC, in collaboration with its partners the EA and NWL, are currently planning a number of modifications to how Murton Gap currently drains. These changes are aimed at both mitigating existing flood risk for the site and surrounding areas and to facilitate future development of Murton Gap. Details regarding the planned flood risk mitigation scheme and changes to drainage infrastructure are provided in the following sections.

5.1.4 A high level drainage strategy has been developed for the site which incorporates the planned flood risk mitigation scheme and changes to the drainage infrastructure. This drainage strategy has been developed to achieve multiple goals, including providing a betterment of flood risk reduction and incorporation of SuDS / green infrastructure in accordance with the goals of local policies. As the next level of detailed design develops, site designers can use the strategic surface water drainage strategy as a guide for designing solutions that are compliant with the strategy and conform to the requirements of NPPF and other applicable policy.

5.2 Planned Flood Risk Mitigation Scheme

5.2.1 To address existing surface water flood risk for Murton Gap and the surrounding area NTC is currently developing a flood mitigation scheme. The proposed scheme currently calls for the construction of three cascading surface water management ponds in the north eastern corner of the site, along with modification of the existing ditch network. A preliminary indicative plan showing the proposed ponds and ditch network is shown in Figure 9 below.

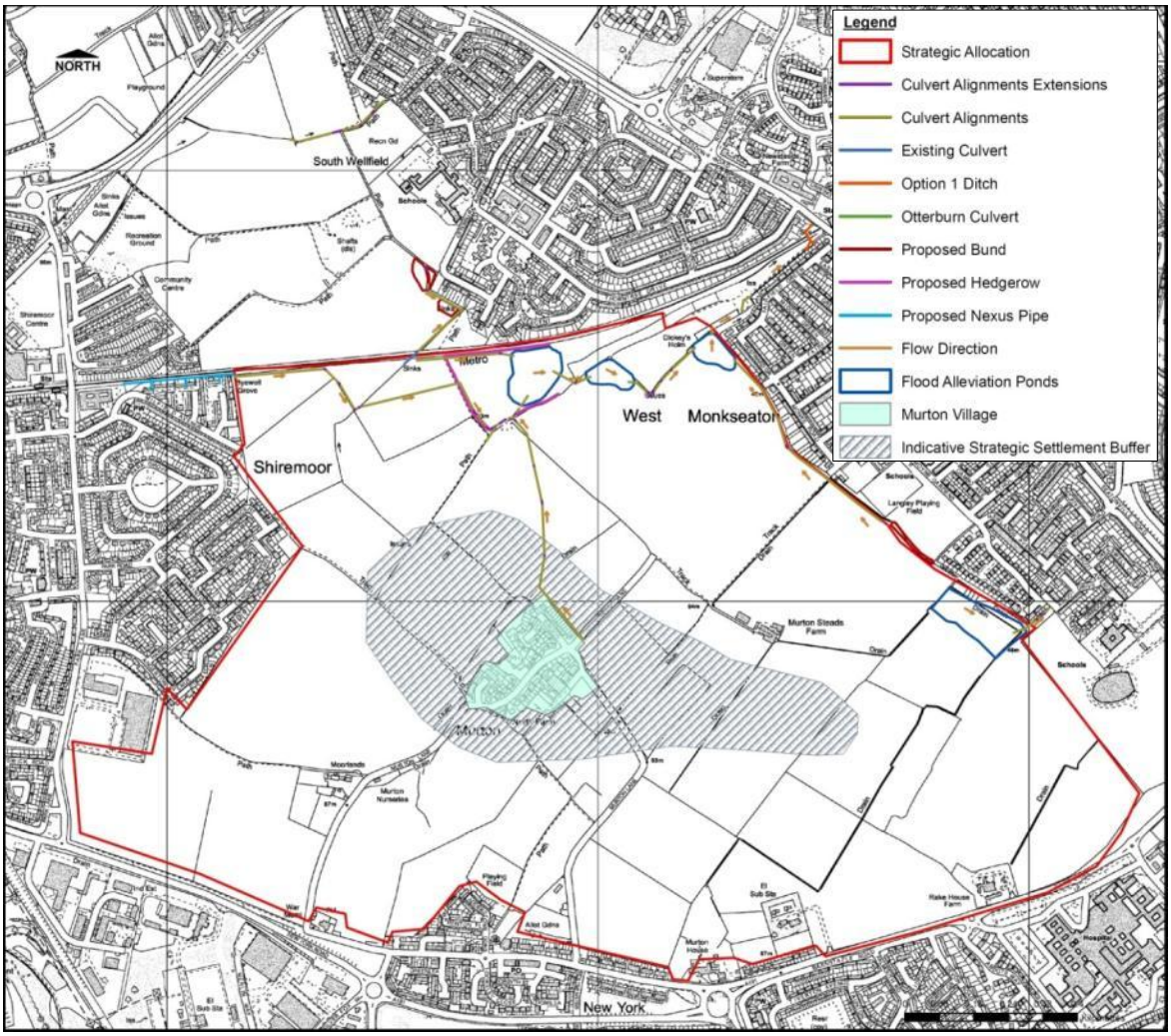


Figure 9: Draft indicative flood mitigation scheme for Murton Gap and surrounding areas

5.2.2 As shown in the draft indicative plan in Figure 9, surface water flows in the Primary Catchment will be directed through a combination of existing and new ditches to cascading surface water management ponds prior to discharging from the site at the culvert at West Monkseaton. A

raised embankment is proposed along the eastern boundary of the site at the Langley Playing Field to intercept flows from leaving the site, instead directing them to the outlet at the north east of the site.

5.2.3 As the scheme is currently under development details such as attenuation volumes for the ponds are not available, however the intent is that the ponds will be designed to attenuate the maximum amount of surface water possible given available land, topography and other constraints. The Council has specified that these flood risk mitigation works are being conducted to manage existing risk, and that any proposed development within Murton Gap will need to manage flows discharging from their lands in accordance with applicable national and local policy and guidance.

5.2.4 The proposed surface water management ponds will discharge into an existing culvert at West Monkseaton. As part of the planned flood risk mitigation efforts for the area, works to improve the condition of the culvert are also proposed. Removal of built up sediment is proposed along one section of the existing culvert along with other repair work which are anticipated to raise the discharge limit from the site to approximately 340lps.

5.2.5 Additional capacity may be possible following additional improvement works to downstream drainage infrastructure. These improvement works, however, will require additional study (including modelling) to demonstrate that they can be carried out without increasing flood risk downstream. This option can be further explored should development with the proposed flow rate restriction prove challenging.

5.2.6 For the Secondary Catchment, construction of another surface water attenuation pond is proposed to the south of Briar Vale. The location of the pond (as shown in Figure 9) ensures that all surface water flowpaths within the Secondary Catchment can be intercepted and attenuated prior to discharging from the site.

5.2.7 As part of development of the Secondary Catchment, there is an opportunity to further reduce flood risk to Briar Vale and other downstream areas. The outlet of the proposed pond can be redirected to discharge to an existing surface water sewer to the southwest. A new culvert will be constructed along the south eastern boundary of Murton Gap and adjoining lands to an existing surface water sewer located approximately 500m to the southwest. Connection to this surface water sewer will reduce flows to NWL combined sewer, improving the capacity and resilience of the NWL sewerage system. It is recommended that these works be undertaken as part of future development of the Secondary Catchment in Murton Gap.

5.2.8 The North Tyneside Draft Sequential Test also provided further details regarding potential works at Murton Gap to improve the existing drainage:

> *Council is currently working with NWL on a feasibility study which will aim to remove surface water from the system by re-routing water to Marden Quarry Lake. During flood conditions the overflow water from the Quarry would run straight out to sea via a new separate surface water sewer and then out to sea via an existing outfall, relieving pressure on the Howdon Sewerage Treatment Works (STW). The proximity of potential housing development at Murton allows surface water drainage from the southern section of the site to be connected to a culvert at Rake Lane which connects to the Marden Quarry. This would provide a drainage outlet for the new development and also ease the pressure at Howdon STW.*

5.2.9 It is important to note that the Murton Gap flood risk mitigation scheme is currently under development and that any of the information above is subject to change. Developers are directed to contact NTC early in any masterplanning activities for Murton Gap to ensure compliance with these planned flood risk mitigation works.

5.3 Drainage Strategy

5.3.1 The sustainable management of surface water runoff has been a major focus whilst developing the drainage strategy. The guidance identified in Section 2, including NPPF and the core masterplanning objectives established at the outset, has been used to set the framework for the consideration of surface water management across Murton Gap. This includes:

- Identifying two options, one in which the existing drainage regime is maintained, and another which emphasises the use of Green Infrastructure as part of an amenity feature;
- The use of sustainable attenuation to manage runoff;
- Managing discharge for the lifetime of the development to a betterment over existing runoff rates (including the effects of climate change in the future);
- For the purpose of the drainage strategy, pond locations and capacity/size estimates have been made, to demonstrate sufficient land is set aside in the future to manage surface water runoff; and
- An assessment of the suitability of incorporating infiltrating SuDS practices into the design.

5.3.2 Flood risk and surface water drainage issues have been a key influence throughout the development of the drainage strategy. Murton Gap and the surrounding area lie within a CDA, and recent experience of flooding has demonstrated that the surrounding areas can flood under existing (largely Greenfield) conditions at the site. Furthermore, given that capacity throughout NTC is restricted through undersized culverts and/or at sewerage infrastructure at capacity, providing a betterment over existing conditions was identified as a key priority to ensure flood risk is appropriately mitigated.

5.3.3 Given this priority, surface water attenuation features were sized based on restricting post-developed flows to less-than-Greenfield runoff rates. Where surface water discharge limits of the receiving waterbody / public sewer were unknown, these were limited to not exceed one half of the existing Greenfield (‘half Greenfield’) runoff rates. The sizing of attenuation features was undertaken based upon managing surface water runoff from the site up to a 1 in 100 year return period (plus climate change) event.

5.4 Existing Runoff Rates

5.4.1 Existing 'Greenfield' runoff rates for Murton Gap have been calculated using the FEH Statistical Method. The FEH statistical method correlation formula (revised in 2008) is:

QMED = 8.3062AREA0.8510 .0.1536(1000/SAAR) .FARL3.4451 .0.0460BFIHOST^2

Where

QMED = Index flood, which is the median of the set of annual maximum flow peaks and is
equivalent to approximately the 1 in 2 year flow rate (m3/s)
AREA = Area (km2)
SAAR = Average Annual Rainfall (mm)
FARL = A measurement of water bodies in the catchment so that their attenuation effects are considered. If the equation is applied to development sites, it is unlikely that FARL will be relevant so this term becomes 1.0
BFIHOST = a measure of base flow runoff

5.4.2 To determine Greenfield runoff rates for the site a SAAR value of 662mm and a BFIHOST value of 0.312 was utilised.

5.4.3 For Murton Gap the area has been divided into two main catchments based on existing topography, as per the findings of the rolling ball analysis. These catchments include the Primary Catchment, draining the majority of the site (outletting in the north east), and the Secondary Catchment, draining the south eastern portion of the site. The Primary Catchment is sub-divided into three sub-catchments.

5.4.4 To view the catchment sizes and the associated QMED values for each, refer to Table 2.

Table 2: Catchments, contributing drainage areas and greenfield runoff rates

Catchment	Sub-catchment	Contributing Drainage Area	Greenfield Runoff Rate (Q_{MED})
Primary Catchment	1	108 ha	381 lps
	2	5 ha	27.8 lps
	3	45 ha	181 lps
	TOTAL	158 ha	590 lps
Secondary Catchment	-	90 ha	338 lps

5.5 Post-Development Options & Runoff Rates

5.5.1 Two options for Murton Gap were developed as part of the drainage strategy.

Option 1 This option focuses on maintaining the existing drainage regime within Murton Gap. In the Primary Catchment the three surface water management ponds proposed by NTC for flood risk mitigation purposes are enlarged to provide additional attenuation storage volume to accommodate development. In the Secondary Catchment construction of another surface water management pond is proposed adjacent to the pond proposed by NTC for flood risk mitigation purposes. For further details regarding this option, refer to Figure 10.

Option 2 This option focuses on incorporating green infrastructure / sustainable drainage features within a dedicated green belt spanning the site from the south west to the north east – following the existing surface water flowpath. This option proposes the construction of a series of smaller surface water management ponds along a green belt. The ponds would be connected, in turn, to a multi-stage channel, providing amenity and biodiversity benefits for the site. For further details regarding this option, refer to Figure 11.

5.5.2 For each option the volume of each storage area has been sized based on the calculations presented in Appendix C and are considered precautionary as they do not allow for routing or storage during a storm event within the drainage system. The calculations included in Appendix C also do not include Long Term Storage – it is assumed that this will be accommodated as part of the planned development through SuDS or other appropriate measures.

5.5.3 The precise type of attenuation feature has been defined with consideration of landscape, ecology, and amenity so that it fits in with the local character. These are predominantly ponds, however for Option 2, a multi-stage channel combined with amenity features has been proposed.

5.5.4 As part of the drainage strategy for each sub-catchment, consideration has been given to where water will flow. The underlying concept is for runoff to be managed within the Masterplan in a way that does not put residents within the development at risk and wherever possible reduces flood risk to those off site. This underlying principle is integrated into the layout of the Masterplan and location of the surface water attenuation features.

5.5.5 The Masterplan drainage strategy focuses on the sizing and constraints associated with implementing attenuation SUDS, as well as demonstrating that secondary overland flow routes (generally the road network) to the attenuation areas has been included in addition to the primary drainage network through the development (swales and pipes).

5.5.6 In compliance with NPPF, all attenuation features have been sized to contain the 1 in 100 year return period flood extent, plus allowance for climate change over the lifetime of the development (30%), on site.

5.5.7 Post development runoff rates for the site were established in consultation with NTC. For the Primary Catchment, NTC indicated that the outlet for this catchment was estimated to have an allowable discharge limit of 340 lps. No allowable discharge limit was available for the Secondary Catchment, so in accordance with the goal of providing a betterment over existing conditions, a target of restricting the outlflows from this catchment to half-Greenfield rate was established. The allowable discharge rates from the catchments and the betterment over Greenfield runoff rates are summarised in Table 3 below.

Table 3: Allowable discharge rates from the site and corresponding betterment over Greenfield runoff rates

Catchment	Sub-catchment	Contributing Drainage Area	Greenfield Runoff Rate (Q_{MED})	Allowable Discharge	Reduction in Runoff Rate over Greenfield
Primary Catchment	1	108 ha	381 lps	232.4 lps	42%
	2	5 ha	27.8 lps	10.6 lps	
	3	45 ha	181 lps	97 lps	
	TOTAL	158 ha	590 lps	340 lps	
Secondary Catchment	-	90 ha	338 lps	169 lps	50%

5.5.8 Table 4 provides a summary of the maximum storage volumes required during the 1 in 100 year plus climate change return period event, discharging at the allowable rates specified in Table 3.

Table 4: Development Attenuation Volumes

Catchment	Sub-catchment	Required Attenuation Volume (including 30% climate change)
Primary Catchment	1	27,750 m^3
	2	1,250 m^3
	3	11,500 m^3
Secondary Catchment	-	24,000 m^3
	Total	**64,500 m^3**

Option 1 – Maintain Existing Drainage Regime

5.5.9 An indicative plan for Option 1 is shown in Figure 10 below.

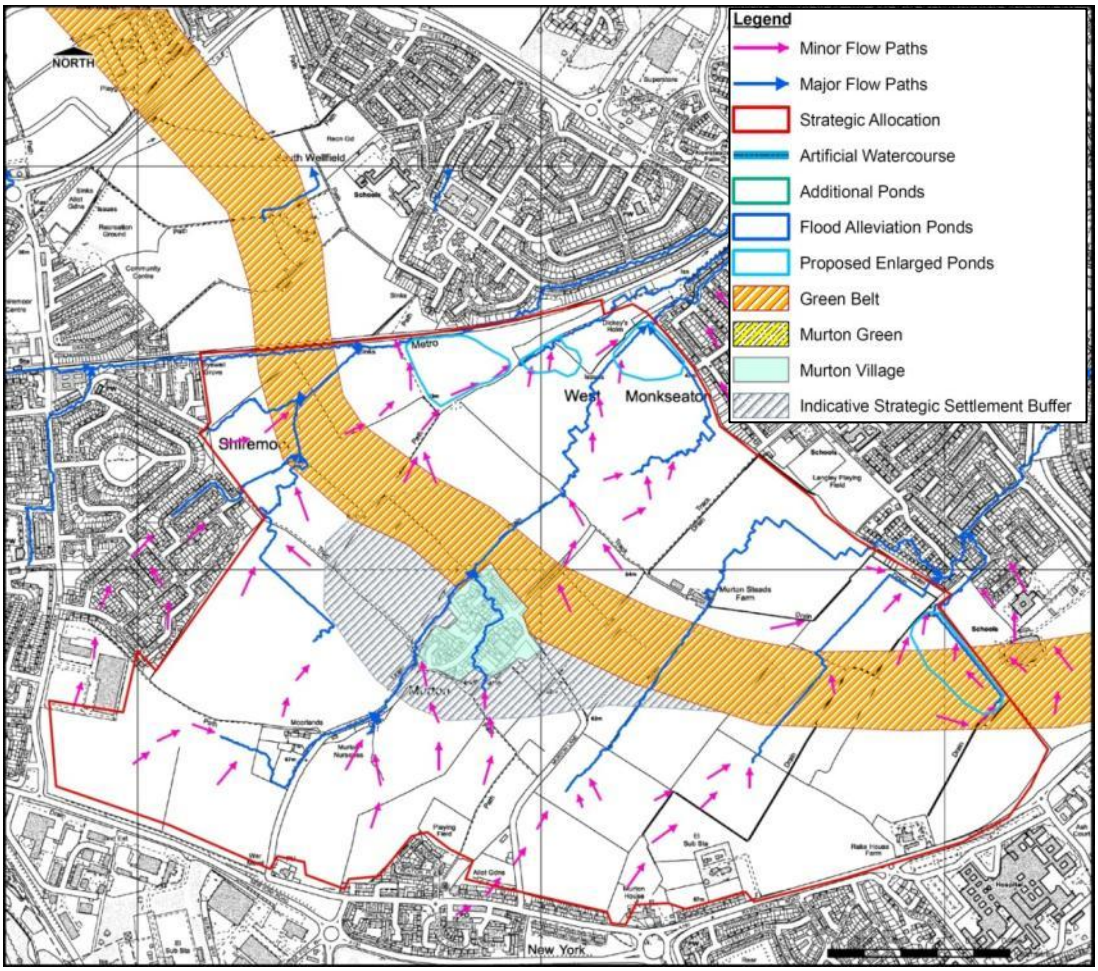


Figure 10: Proposed surface water drainage strategy for Option 1

5.5.10 For the Primary Catchment it is proposed that surface water runoff from development be directed along existing flowpaths to the north eastern corner of the site for attenuation. To simplify construction requirements for the project it is proposed that the footprints of ponds planned as part of the flood risk mitigation scheme be expanded to accommodate runoff from development. Existing flowpaths will likely need to be modified and / or new flowpaths created in order to convey flows to the new ponds, however, identifying flowpaths will require a development layout proposed as part of the master plan.

5.5.11 The surface water management pond footprints in the Primary Catchment have been sized in accordance with the maximum allowable discharge limit of 340 lps, as specified by NTC. The

proposed location and size of the surface water attenuation ponds is indicative and would require further verification as part of outline / detailed design.

5.5.12 For the Secondary Catchment, expansion of the planned flood mitigation pond was also considered, however, due to site topography expansion of the pond was not possible. As such another surface water attenuation pond is proposed to the south.

5.5.13 As with the Primary Catchment, surface water in the Secondary Catchment will be directed along existing flowpaths to the proposed pond location.

5.5.14 The proposed pond location and size will need to be verified as part of outline / detailed design, and flowpaths will need to be determined once indicative development layouts are available.

Option 2 – Green Infrastructure

5.5.15 An indicative plan for Option 2 is shown in Figure 11 below.

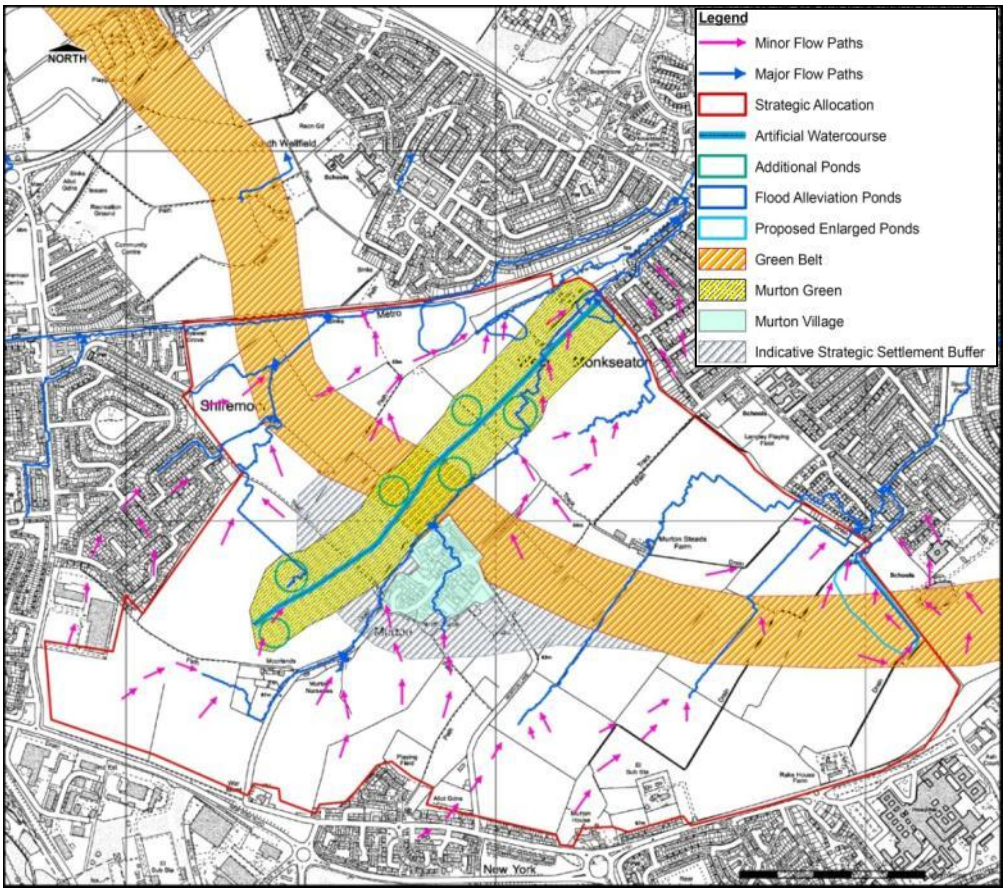


Figure 11: Proposed surface water drainage strategy for Option 2

5.5.16 Option 2 proposes the establishment of another green belt (called 'Murton Green') within the Primary Catchment. This green belt will be implemented along existing overland flowpaths and will provide a multi-purpose area to not only convey surface water flows and attenuate surface water, but incorporate amenity features such as through the creation of a multi-stage channel complete with pedestrian / cycle path. This approach maximises the use of green infrastructure on-site, and provides increased biodiversity opportunities through an appropriately landscaped / naturalised multi-stage channel.

5.5.17 Indicative locations of surface water management ponds shown on Figure 11 have been selected to maximise the use of existing topography and to intercept existing surface water flowpaths. Attenuation storage within the Primary Catchment has been sized in accordance with the specified maximum discharge rate of 340lps through the downstream culvert.

5.5.18 For the Secondary Catchment, use of the master plan's green belt was considered as part of expanding the green infrastructure / amenity created for the Primary Catchment. This option was examined by reviewing available topographic information for the site. This review, however, found that that incorporating smaller attenuation features along a multi-stage channel in the master plan green belt is likely not feasible for the Secondary Catchment given existing ground levels. As such, use of a single large attenuation feature in the location specified in Figure 11 is recommended for both Options 1 and 2.

Opportunities & Constraints Summary

5.5.19 Opportunities and constraints associated with the two options presented as part of the drainage strategy are presented in Table 5 below. These opportunities and constraints should be considered when determining the preferred option for the drainage strategy for the site.

Table 5: Opportunities and constraints summary table

Option	Opportunities	Constraints
Option 1	• Enlarging flood risk mitigation ponds to accommodate flows from future development may reduce total site development costs. • Location of surface water management ponds are concentrated, simplifying access requirements to permit long-term maintenance.	• Large area required in the north eastern corner of the site, outside of the proposed green belt / amenity area. • Proposed pond locations / sizes will need to be verified as part of outline and detailed design process.
Option 2	• Use of a series of smaller ponds more closely follows the SuDS management train philosophy. • Potential for premium sale values as more properties will back onto water features. • Opportunity to create an amenity feature where residents and visitors can walk along a new naturalised channel / water feature. • Increased biodiversity with naturalised channel / water feature.	• Additional land take for the secondary green belt (‘Murton Green’). • Access to ponds will need to be incorporated into development layouts to ensure long-term maintenance. • Proposed pond locations / sizes will need to be verified as part of outline and detailed design process.

6. SuDS Suitability Assessment

6.1.1 To assess the suitability of incorporating infiltrating SuDS practices within Murton Gap, SuDS Infiltration Mapping data was obtained from BGS.

6.1.2 The SuDS suitability assessment found that the Secondary Catchment has a number of constraints and issues that may make incorporating infiltrating SuDS infeasible or challenging. Conversely, the BGS SuDS Infiltration Mapping dataset indicates that the Primary Catchment provides much greater opportunities (and fewer constraints) for the implementation of infiltration SuDS. To view the BGS data and its assessment in detail, please refer to Appendix D.

6.1.3 Given that the BGS data indicates that there are some opportunities for SuDS on Murton Gap, it is recommended that site investigations be conducted to further assess the suitability of incorporating infiltrating SuDS into the Murton Gap masterplan. A geotechnical assessment, including investigation of potential geohazards and determine of infiltration rates, should be conducted for both the Primary and Secondary Catchments, to verify the suitability of each catchment.

6.1.4 If detailed site investigations find that infiltrating SuDS are not feasible for part or all of Murton Gap, non-infiltrating SuDS practices should be implemented to the greatest extent possible. These practices include green roofs and rainwater harvesting.

7. Summary and Flood Risk Mitigation Recommendations

7.1.1 Capita Property & Infrastructure was commissioned by NTC in April 2015 to develop a strategic flood risk assessment and drainage assessment for Murton Gap. Murton Gap has been identified in North Tyneside Council's (NTC) 2015 Draft Local Plan as a potential site to accommodate approximately 2,800 - 3,000 homes.

7.1.2 Flood risk from fluvial, tidal and artificial sources is considered to be low at Murton Gap. Groundwater flood risk varies across the site, and is considered to be low to moderate based upon available data. The EA's uFMfSW and historical flooding records indicate that the site is at moderate risk from surface water flooding. Several existing surface water flowpaths are predicted to cause flooding at structures and properties surrounding Murton Gap. A majority of the Murton Gap lands are located within the West Monkseaton CDA.

7.1.3 Development layouts were not available at the time of writing, but a mixture of land uses have been proposed for the site including: residential homes, educational facilities, public open space / green belt, link roads and employment land. The flood risk vulnerability classification of these uses ranges from 'Less Vulnerable' to 'Essential Infrastructure.' The NPPF states that all of these land uses are compatible for development within Flood Zone 1. It is important to note, however, that Murton Gap is located in a CDA and contributes to wider surface water issues. As such further consideration must be given to flood risk to ensure that development can take place whilst not increasing flood risk at the site and surrounding area.

7.1.4 To address the existing surface water flood risk for Murton Gap and the surrounding area, NTC is currently developing a flood mitigation scheme for the site that includes the construction of several surface water management ponds, works to the existing ditch network, and repairs to culverts carrying flows discharging from the site.

7.1.5 A drainage strategy was developed for the site that took the planned flood risk mitigation scheme into account. To reduce surface water runoff generated from the site surface water attenuation features were sized based on restricting post-developed flows to less-than-Greenfield runoff rates. This approach restricted the allowable discharge rate from the Primary Catchment to 340 lps and the Secondary Catchment 169 lps, a reduction in runoff rate over Greenfield conditions by 42% and 50% respectively.

7.1.6 The sizing of attenuation features was undertaken based upon managing surface water runoff from the site up to a 1 in 100 year return period (plus climate change) event. In accordance with these criteria, an attenuation storage volume of 40,500 m3 for the Primary Catchment and 24,000 m3 for the Secondary Catchment.

7.1.7 To accommodate these storage volumes two options were developed as part of a drainage strategy for Murton Gap. One option prioritises the use of the existing drainage regime to manage surface water runoff at the site. A second option proposes the establishment of another green belt, 'Murton Green' to provide a multi-purpose space to accommodate attenuation ponds and other sustainable drainage features, complete with a multi-stage channel for conveyance of surface water to its discharge point at West Monkseaton.

7.1.8 A SuDS suitability assessment conducted for the site found that there are a number of constraints in the south eastern portion of the site that may make incorporating infiltrating SuDS infeasible or challenging in this area. Conversely, the assessment found that the south western portion of the site, and a small area in the north eastern corner of the site provides much greater opportunities) for the implementation of infiltration SuDS. It is recommended that site investigations be conducted to further assess the suitability of incorporating infiltrating SuDS into the Murton Gap masterplan.

7.2 Flood risk mitigation & development recommendations:

7.2.1 Below are flood risk mitigation measures to take as part of development of the Murton Gap site:

- The development layout should include the provision for overland flow routes within the layout, so that surface water from the land is channelled into the attenuation features, keeping residents within and around the Murton Gap strategic lands safe during extreme and intense rainfall events.

- SuDS should be incorporated the development layout to the greatest extent possible. SuDS Infiltration Mapping data (Appendix D) and future site investigations should guide the placement of infiltrating SuDS to the most beneficial locations on site. Non-infiltrating SuDS like rainwater harvesting and green roofs should be used where infiltration is not feasible.

- As a best practice approach, finished floor levels should be raised by 300 mm above finished ground levels to mitigate surface water flood risk. Essential infrastructure and critical electrical systems within buildings should also be adequately raised / protected.

- Adopting the multi-purpose green belt (‘Murton Green’) is recommended as a drainage strategy for the site. This option provides the opportunity to create a multi-stage channel with multiple distributed surface water attenuation features. Use of this approach provides an increased area / buffer to manage overland flows on site, provide an amenity space for residents and visitors and increase the site’s biodiversity.

- The development layout must take into consideration the Sequential Approach to development – locating development in areas at lower flood risk – as specified by the North Tyneside Draft Sequential Test.

- The development layout must take into consideration the existing sewerage infrastructure on the site, particularly the large combined sewer storage tank in the north western portion of the site. NWL should be consulted early in the master planning process, especially during development of an outline drainage strategy for the site.

- The EA should be consulted for further recommendations regarding flood risk mitigation.

Appendix A Site Plans and Topography

Appendix B Flood Risk Mapping

Appendix C Site Plans and Topography

Appendix D SuDS Suitability Assessment

To assess the suitability of incorporating infiltrating SuDS practices within Murton Gap SuDS Infiltration Mapping data was obtained from BGS. The Infiltration SuDS Map comprises a GIS dataset in four thematic sections which together provide answers to four key questions. The four questions are:

Question 1. Are there any constraints that mean infiltration SuDS should only be used if the potential for and consequences of flooding and geohazards are known?
This step addresses the potential presence of geological and hydrogeological hazards that could be initiated or worsened by infiltrating water to the ground. In such areas, infiltration is not recommended unless a full appraisal of the potential for and consequences of infiltration has been undertaken. Possible hazards include:

i) ground instability resulting from the infiltration of water into rocks that are highly susceptible to landslide or collapse associated with dissolution or shallow mining;
ii) flooding resulting from infiltration into deposits where the water table is shallow and potentially able to rise causing inundation of soakaways or emergence of groundwater at the ground surface, and
iii) made ground of unknown characteristics that may be unstable or potentially contaminated.

Question 2. What is the drainage potential of the subsurface?
The drainage potential of the ground depends on the geology and hydrogeology of the subsurface. This step provides information on the depth to water table, the permeability of superficial deposits, the thickness of superficial deposits and the permeability of the bedrock. Data is also provided on the presence of deposits that lie on a floodplain; in such deposits, groundwater level may respond rapidly to rises in river level causing inundation of subsurface systems.

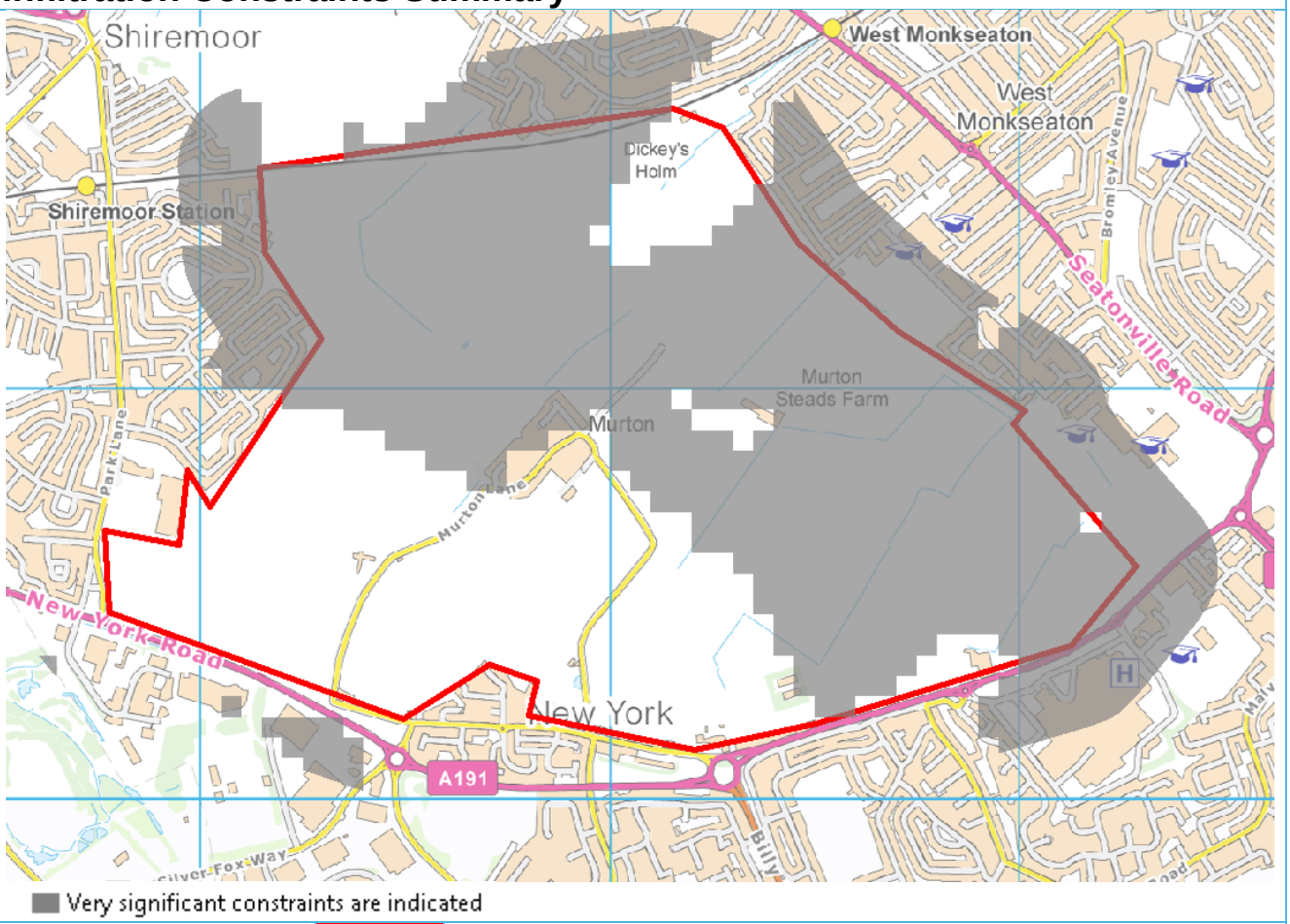
Question 3. Are there any ground stability considerations?
Not all ground instability hazards will preclude the installation of infiltration SuDS, but if present, those hazards should be taken into account during design and construction. Where such hazards are thought to be present, they are highlighted in this step. Hazards considered include soluble rocks, landslides, compressible ground, collapsible ground, shrink-swell clays, running sand and shallow mining (excluding coal mining).

Question 4. Is the groundwater susceptible to deterioration in quality?
When designing SuDS installations the potential impact on groundwater quality should be considered. This step provides information on the EA source protection zone classification, the predominant flow mechanism through the unsaturated zone and on the presence of made ground, which may be contaminated. This information can be used, in part, to determine likely pre-treatment requirements.

The BGS specifies that the SuDS Infiltration Mapping dataset is intended to provide the information required to make a preliminary decision on the extent to which the subsurface at a site is suitable for the installation of infiltration SuDS. The data is not an alternative for a site investigation or an infiltration test.

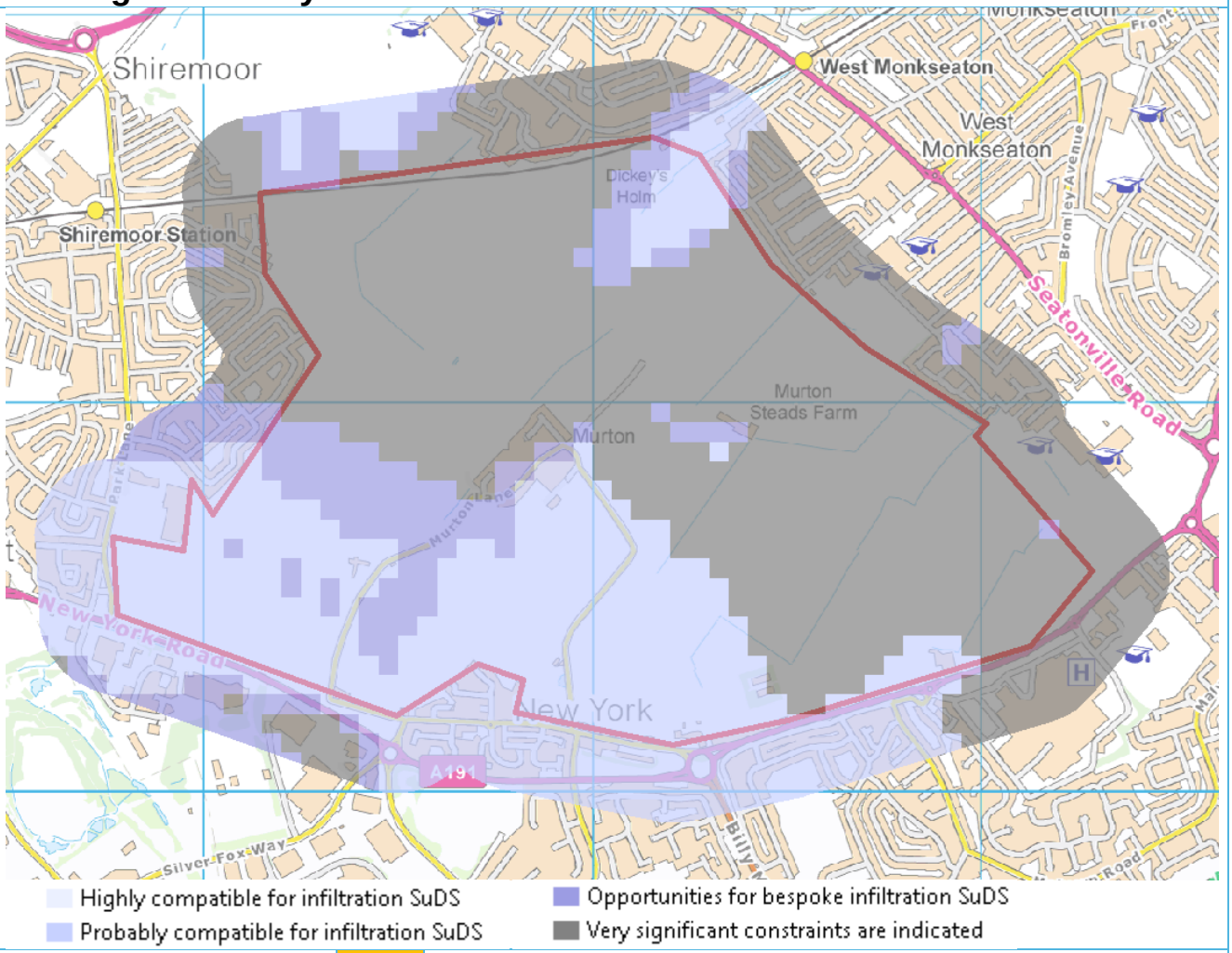
The Infiltration SuDS Mapping data is analysed on the following pages.

Infiltration Constraints Summary



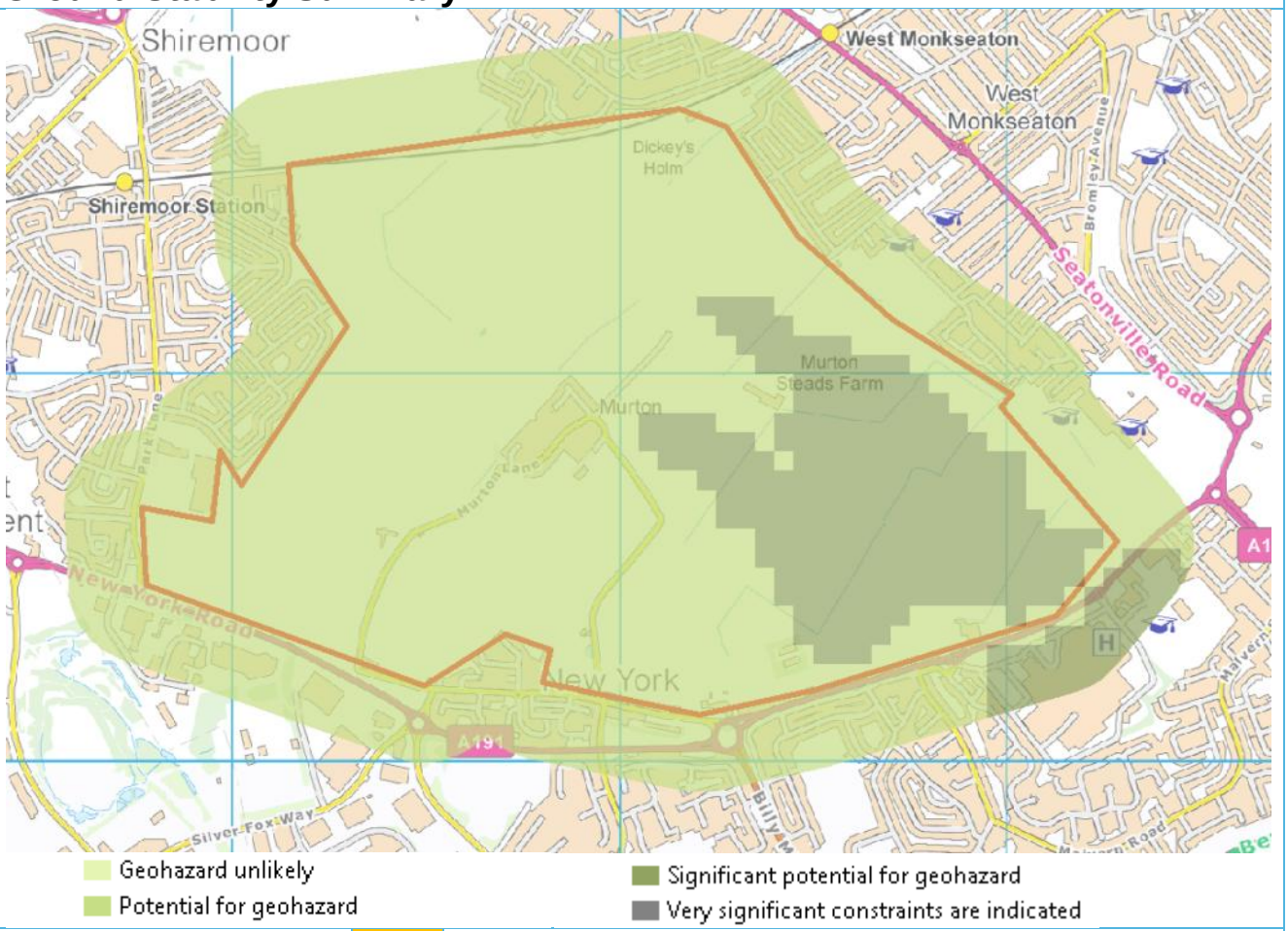
Are there infiltration constraints where SuDS are proposed?		Yes
Comments	The infiltration constraints layer indicates that there are very significant constraints that can impact the effectiveness of infiltrating SuDS practices for approximately 50% of Murton Gap. This affected region roughly occupies the northern portion of the Primary Catchment, for lands north of the Village of Murton. Significant constraints are predicted for a portion of the land proposed for the 'Murton Green' multi-purpose attenuation and amenity green belt. However, this indicates that there may be infiltration opportunities along the southern and northern stretches of Murton Green. Much of the Secondary Catchment appears to have very significant constraints to implementing infiltrating SuDS. The infiltration constraints summary layer indicates that in the affected locations there is a very significant potential for one or more geohazards associated with infiltration. Any site investigation should consider whether the potential for, or the consequences of infiltration, are significant.	

Drainage Summary



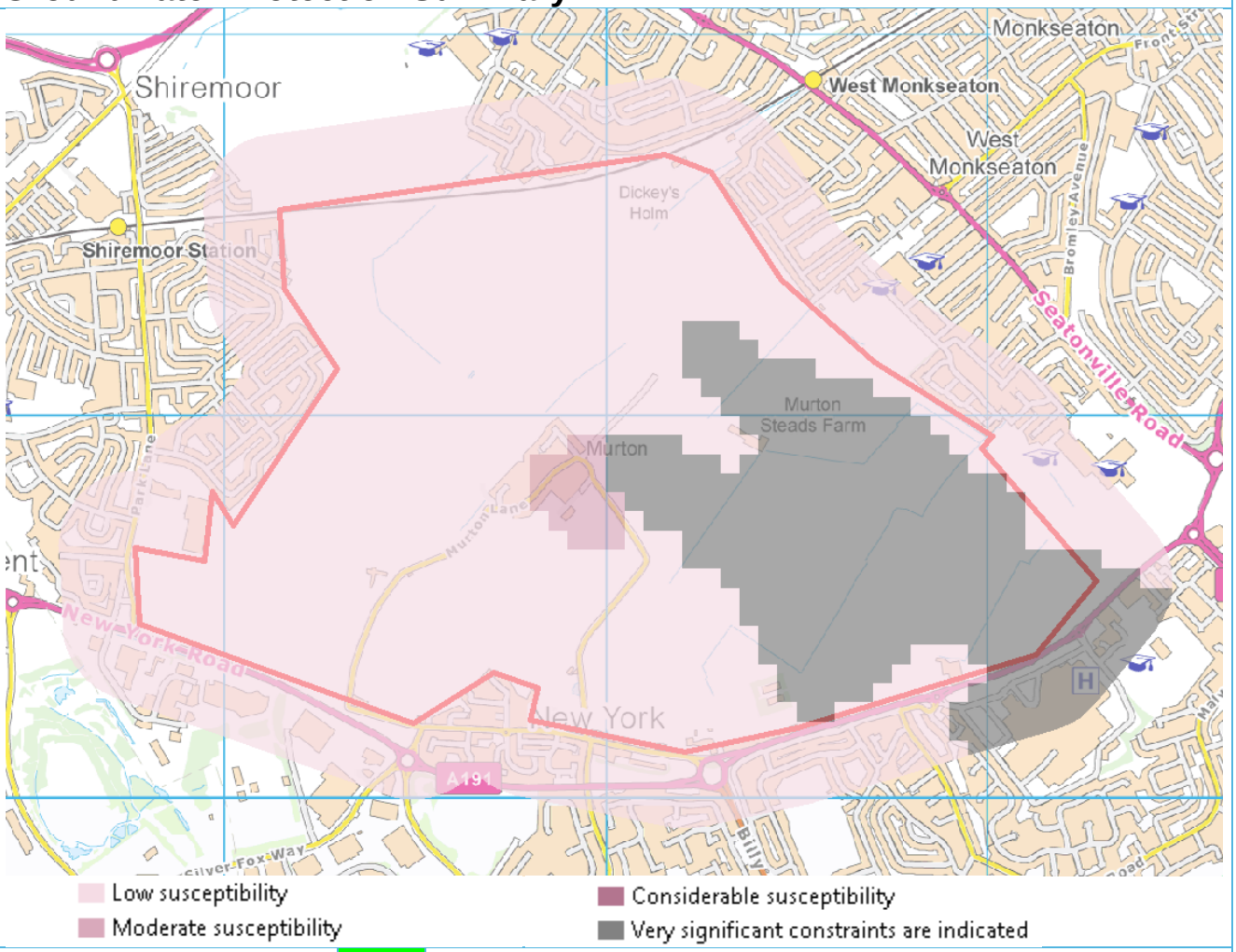
Is the subsurface compatible for infiltration SuDS?		Varies
Comments	The Drainage Potential layer provides further details regarding the compatibility of locations for infiltration SuDS. As with the infiltration summary layer in the previous image, it can be seen that 50% of the development site is affected by very significant constraints. The south western corner of the site and land south of Murton Village however can be considered as being highly compatible for infiltration SuDS. The drainage summary layer states that for these locations, the subsurface is probably suitable for infiltration SuDs although the design may be influenced by the ground conditions. Infiltration rates should also be quantified via an infiltration/soakaway test. A small area in the north eastern corner of Murton Gap also shows compatibility for incorporating infiltrating SuDS. In these location, infiltration SuDS may be practical to supplement on-site attenuation ponds, but will require further investigation.	

Ground Stability Summary



Are there any ground stability considerations?		Varies
Comments		The Ground Stability Summary layer provides an indication of locations potentially subject to geohazard based on a number of parameters, including landslides, running sand and shallow mining. For Murton Gap it can be seen that the vast majority of the site falls within the category “Potential for geohazard”. In these locations, ground instability problems may be present or anticipated but increased infiltration is unlikely to result in ground instability. The advice states that before installing infiltration SuDS that the potential for (or the consequences of) infiltration impacting ground stability should be investigated. Approximately 20% of the site (and a majority of the Secondary Catchment) within the south eastern corner stretching from the centre near Murton south east towards the A191 has had very significant constraints indicated. In this context, ground instability problems are present and increased infiltration may result in further instabilities. Any installation of SuDS in these locations should consider the consequences or potential of increased infiltration affecting stability.

Groundwater Protection Summary



Within the constraints of the data provided, is the groundwater susceptible to deterioration in quality?		Low to Moderate risk to groundwater quality
Comments	The groundwater protection summary layer indicates that the majority of the site is designated as “low susceptibility” and therefore groundwater is not expected to be especially vulnerable to contamination and infiltrating water should be free of contaminants. The groundwater protection summary has also identified that approximately 20% of the site from the centre of the site stretching to the south eastern corner has very significant constraints present. In this location, the layer states that ‘made ground’ is present at the surface. Infiltration may increase the possibility of remobilising pollutants. The advice states that infiltration SuDS should only be installed if the potential for contaminant leaching are considered not to be significant. A small portion of the site is designated as “moderate susceptibility” around the settlement of Murton itself in the middle of the development area. Before installing infiltration SuDS in this location the risks associated with the transport of contaminants to the groundwater should be considered and previous land uses and potential for the presence of contaminated ground should be checked.	

Appendix D

Capita Property and Infrastructure Ltd
65 Gresham Stret
London
EC2V 7NQ