



South Tyneside Council

South Tyneside Council

Preliminary Flood Risk Assessment

In fulfilment of Section 10 of the Flood Risk Regulations (2009)

June 2011



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Executive Summary

This report is the Preliminary Flood Risk Assessment (PFRA) for South Tyneside Council. The report has been prepared to meet the Council's statutory duty under Section 10 of the Flood Risk Regulations (2009). This PFRA has considered past and potential future flood risk within South Tyneside from all local sources of flood risk (*Surface Water, Groundwater and Ordinary Watercourse flooding*). In accordance with the Regulations, all other sources of flood risk within South Tyneside (*Main River, Sea and Reservoir flooding*) have been considered by the Environment Agency.

The effects of flooding can be devastating to local communities, and on occasion this devastation has occurred at a local level within South Tyneside. This PFRA draws together records of historic flooding from all relevant agencies operating within South Tyneside. The report has collated evidence of 152 historic flooding incidents in South Tyneside. These reported flooding incidents have varied greatly in their impact and significance and due to different reporting mechanisms it has been decided that these flooding events have not had 'significant harmful consequences' and will not be included in the spreadsheet appended to this report for submission to the European Commission. It is however acknowledged that on a local level these flooding incidents may have been significant to those communities affected.

This Preliminary Flood Risk Assessment has considered potential future flood risk in South Tyneside; no local information exists with regard to predicted future flood events therefore national datasets have been utilised. The assessment has identified that within South Tyneside approximately 4000 residential premises and 100 businesses or critical services may be affected by future flooding. While this future flood risk is of a local concern for South Tyneside this number of affected residents is not considered to be nationally significant and as such South Tyneside is not considered to have any Indicative Flood Risk Areas according to the national criteria produced by DEFRA.

South Tyneside Council therefore has no requirement to produce Flood Hazard Maps or Management Plans, as required under the Regulations.



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Glossary

Asset	A structure or a system of structures used to manage flood risk.
AStSWF	Areas Susceptible to Surface Water Flooding (Flood Map)
Catchment	An area that serves a river with rainwater. Every part of land where the rainfall drains to a single watercourse is in the same catchment.
CFMP	Catchment Flood Management Plan
Coastal erosion	The wearing away of the coastline, usually by wind and/or wave action
Coastal flooding	Occurs when coastal defences are unable to contain the normal predicted high tides that can cause flooding, usually when a high tide combines with a storm surge (created by high winds or very low atmospheric pressure)
Culvert	A covered structure under a road, embankment etc to direct flow of water.
Defence	A structure that is used to reduce the probability of floodwater or coastal erosion affecting a particular area (for example, a raised embankment or sea wall)
DEFRA	Department for Environment, Food and Rural Affairs
DG5	Records of flooding issues relating to surface and foul water sewers, held by the sewerage undertaker.
EA	Environment Agency
EC	European Commission
FCERM	Flood and Coastal Erosion Management
Flood	The temporary cover by water of land not normally covered with water.
Flood Risk Area	An area determined as having a significant risk of flooding in accordance with guidance published by DEFRA and WAG
FMfSW	Flood Map for Surface Water
FWMA	Flood and Water Management Act (2010)
Groundwater	Water which is below the surface of the ground and in direct contact with the ground or subsoil.
Groundwater flooding	Occurs when water levels in the ground rise above the natural surface. Low-lying areas underlain by permeable strata are particularly susceptible.
Indicative Flood Risk Areas	Areas determined by the Environment Agency as indicatively having a significant flood risk, based on guidance published by DEFRA and WAG and the use of national datasets. These indicative areas are intended to provide a starting point for the determination of Flood Risk Areas by LLFAs.
LDF	Local Development Framework
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
LRF	Local Resilience Forum
Main River	A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers.



NRD	National Receptor Dataset – A collection of risk receptors produced by the Environment Agency.
NWL	Northumbrian Water Limited
Ordinary Watercourse	All watercourses that are not designated Main River, and which are the responsibility of Local Authorities, or where they exist Internal Drainage Boards
PPS 25	Planning Policy Statement 25: Development and Flood Risk
PFRA	Preliminary Flood Risk Assessment
RBD	River Basin District
Recovery	The process of rebuilding, restoring and rehabilitating the community following an emergency
Resilience	The ability of the community, services, area or infrastructure to withstand the consequences of an incident
RFCC	Regional Flood and Coastal Committee
RFDC	Regional Flood Defence Committee
Risk Management Authorities	Organisations that have a key role in flood and coastal erosion risk management as defined by the Flood and Water Management Act (2010). These are the Environment Agency, Lead Local Flood Authorities, Internal Drainage Boards, Water Companies and Highways Authorities.
River flooding	Occurs when water levels in a channel overwhelms the capacity of the channel.
SAB	SUDS Approval Body
SFRA	Strategic Flood Risk Assessment
SUDS	Sustainable Drainage Systems
Surface Water Flooding	Occurs when the level of rainfall overwhelms the capacity of the drainage system to cope.
SWMP	Surface Water Management Plan
WAG	Welsh Assembly Government



1.0 Introduction

1.1 Preliminary Flood Risk Assessment

This document outlines the findings of a Preliminary Flood Risk Assessment (PFRA) for South Tyneside Council. The recently completed Strategic Flood Risk Assessment (SFRA) for South Tyneside Council (February 2011) provides a significant amount of contextual information in relation to all forms of flood risk within South Tyneside and may be used to gain further background information.

This report has been undertaken in response to the obligations placed on South Tyneside Council by the Flood Risk Regulations (2009) and the Flood and Water Management Act (2010). This new legislation has placed a number of key responsibilities on Local Authorities with regards to Local Flood Risk Management.

The Flood Risk Regulations transpose the EC Floods Directive (Directive 2007/60/EC on the assessment and management of flood risk) into domestic law in England and Wales. The legislation defines certain local authorities, such as South Tyneside Council, as Lead Local Flood Authorities (LLFAs) for the purpose of Flood Risk Management.

Section 10 of the legislation requires Lead Local Flood Authorities to prepare a preliminary assessment of flooding in relation to its administrative area in relation to past and possible future flooding from the following local sources:

- Surface Water
- Groundwater
- Ordinary watercourses; and
- Canals (where appropriate).

The Environment Agency has responsibility for producing Preliminary Flood Risk Assessments in relation to flooding from the following sources:

- The Sea;
- Main rivers; and
- Reservoirs.

Flooding from these sources will not be covered as part of this PFRA, unless it is considered that it may affect flooding from one of the sources considered by the LLFA. This PFRA will consider flooding events which have significant harmful consequences for human health, economic activity and the environment. In accordance with the legislation, South Tyneside Councils PFRA will be submitted to the Environment Agency for review, further modifications may be required following this review.



Table 1.1 identifies the Lead Local Flood Authority (LLFA) responsibilities under the Flood Risk Regulations (2009), the first two requirements outlined in red, are covered by the preparation of this PFRA report.

Table 1.1. LLFA Responsibilities under the Flood Risk Regulations 2009		
Due Date	Action	Detail
22/06/2011	Prepare Preliminary Assessment Report	The PFRA should focus on local flood risk from surface water, groundwater, ordinary watercourses and canals.
22/06/2011	On the basis of the PFRA, identify Flood Risk Areas .	Flood Risk Areas are areas of significant risk identified on the basis of the findings of the PFRA, national criteria set by the UK Government Secretary of State and guidance provided by The Environment Agency.
22/06/2013	Prepare Flood Hazard Maps and Flood Risk Maps for each Flood Risk Area.	Used to identify the level of hazard and risk of flooding within each Flood Risk Area to inform Flood Risk Management Plans.
22/06/2015	Prepare Flood Risk Management Plans for each Flood Risk Area.	Plans setting out risk management objectives and strategies for each Flood Risk Area.

1.2 Study Area

The Borough of South Tyneside (*Figure 1.2*) is located on the south bank of the River Tyne extending from the river mouth at South Shields, west to Gateshead, and is bound to the south by the City of Sunderland and to the east by the North Sea. The Borough incorporates the conurbations of Boldon, Cleadon, Hebburn, Jarrow, South Shields and Whitburn.

Covering an area of 64 square kilometres, South Tyneside has a population of approximately 151,600 (as of mid 2008). Topographically, much of the Borough is flat with the exception of the Cleadon hills. The study area falls into the Northumbria River Basin District and is served by Northumbrian Water Limited, the local water and sewerage provider. The study area falls within the Environment Agency Yorkshire and North East Region and is covered by the Northumbria Regional Flood Defence Committee (RFDC) [*Soon to be the Northumbria Regional Flood and Coastal Committee (RFCC)*].



Figure 1.2. South Tyneside Council Administrative Area



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1.3 Aims and Objectives

The PFRA is a high level screening exercise, utilising guidance from central government, to identify nationally significant flood risk areas within the context of the EC Floods Directive. It is possible that there may be significant areas of local flood risk that may not be reflected in this document; however these will be addressed in the emerging Local Flood Risk Strategy which South Tyneside Council is required to develop under the Flood and Water Management Act (2010).

The PFRA will identify areas where the risk of surface water, groundwater and flooding from ordinary watercourses are significant and warrant further examination through the production of maps and management plans.

The key objectives of this study are:

- To identify partnerships with relevant authorities and enhance understanding and information sharing between all parties;



- Provide a summary of the systems used for data sharing and storing, and provision for quality assurance, security and data licensing arrangements;
- Summarise the methodology adopted for the Preliminary Flood Risk Assessment with respect to data sources, availability and review procedures;
- Assess historic flood events within the study area from local sources of flooding (including flooding from surface water, groundwater and ordinary watercourses), and the consequences and impacts of these events;
- Establish an evidence base of historic flood risk information, which will be built up on in the future and used to support and inform South Tyneside Council's Flood Risk Strategy;
- Assess the potential harmful consequences of future flood events within the study area;
- Review the provisional national assessment of indicative Flood Risk Areas provided by the Environment Agency and provide explanation and justification for any amendments required to the Flood Risk Areas.



2.0 Lead Local Flood Authority Responsibilities

2.1 Introduction

The preparation of a Preliminary Flood Risk Assessment (PFRA) is one of several responsibilities South Tyneside Council must undertake with regards to Flood and Coastal Erosion Risk Management. This section aims to illustrate the current flood risk and coastal erosion management responsibilities and the interaction between these responsibilities.

There are a number of interested authorities, individuals and organisations within the South Tyneside area that have an active involvement or interest in Flood Risk and Coastal Erosion Management. These groups and individuals have been working closely for a number of years, although it is proposed that these working arrangements will be strengthened in the future. Figure 2.1 identifies the current partnership arrangements that exist in South Tyneside:

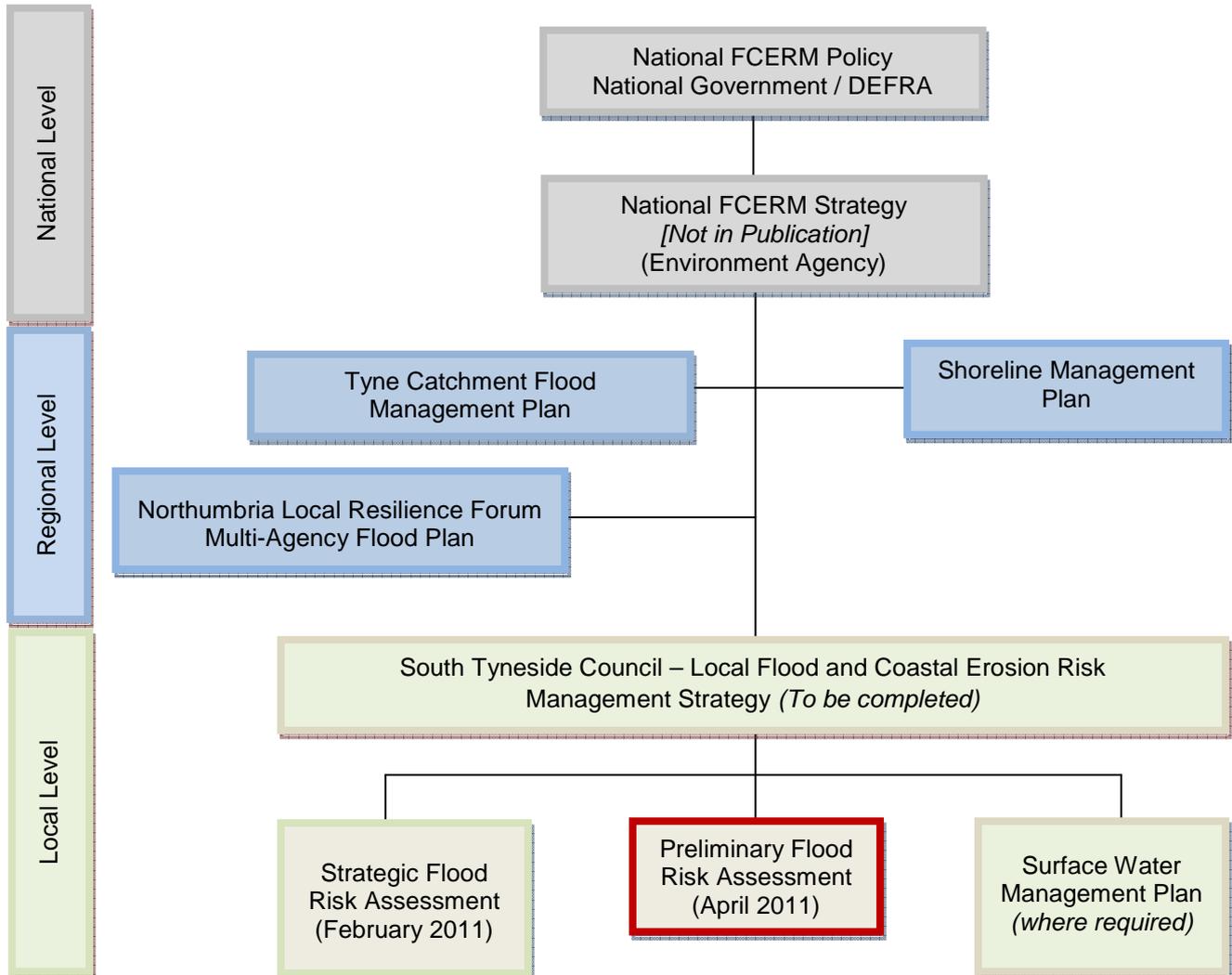
Figure 2.1: Partnership Arrangements – South Tyneside Council (LLFA)





Figure 2.2 identifies the current strategic policies, plans, guidance and documentation relating to the strategic management of flood risk and coastal erosion within South Tyneside.

Figure 2.2 Flood and Coastal Erosion Risk Management Framework – South Tyneside Council





2.2 Additional Responsibilities

There are a number of additional responsibilities placed on Lead Local Flood Authorities as a result of the Flood and Water Management Act (2010) and the Flood Risk Regulations (2009). A number of these responsibilities will require commencement orders to bring this new legislation in to force, at present the scheduling of some of these orders is unknown. These responsibilities are identified below:

- **Investigating flood incidents** – Under the provisions of the Flood and Water Management Act (2010) LLFAs have a duty to investigate, to the extent that it considers necessary or appropriate, and record details of flooding incidents in its area. The investigation must determine which risk management authorities have relevant flood risk management functions, and whether each of those risk management authorities has exercised, or is proposing to exercise those functions in response to the flood and results of the investigation must be published and notified to the relevant risk management authorities. (Commencement Date: 6th April 2011).

Not every flood that occurs and is reported can be investigated; criteria will be developed by South Tyneside Council for deeming whether an investigation is necessary or appropriate.

- **Asset Register** – LLFAs must establish and maintain a register of structures or features which are considered to have an effect on flood risk, including details of ownership and condition. (Commencement Date: 6th April 2011)
- **SUDS Approving Body** – It is proposed that Lead Local Flood Authorities will be the designated SUDS Approving Body (SAB) for any new drainage system, and therefore must approve, adopt and maintain any new sustainable drainage systems (SUDS) within their area. (Not commenced to date).
- **Local Strategy for Flood Risk Management** – Lead Local Flood Authorities must develop, maintain, apply and monitor a strategy in its area in relation to local flood risk from surface runoff, groundwater and ordinary watercourses. The local strategy will be consistent with the national flood and coastal erosion risk management strategy for England. (Commencement Date: 1st October 2010)
- **Works Powers** – LLFAs have powers to undertake works to manage flood risk from surface runoff and groundwater, consistent with the local flood risk management strategy for the area.
- **Designation Powers** – LLFAs, along with the Environment Agency, have powers to designate features and structures that affect flooding or coastal erosion in



order to safeguard assets that are relied upon for flood or coastal erosion risk management. (Commencement Date: 6th April 2011)

2.3 Public Engagement

It is recognised that members of the public may hold relevant information regarding flood risk. South Tyneside Council recognise the importance of public engagement when undertaking local flood risk management plans. South Tyneside Council will consider the guidelines outlined in the Environment Agency's 'Building Trust with Communities' document which provides a useful process of how to communicate risk including the causes, probability and consequences of flooding to the general public.

3.0 Methodology and Data Review

3.1 Introduction

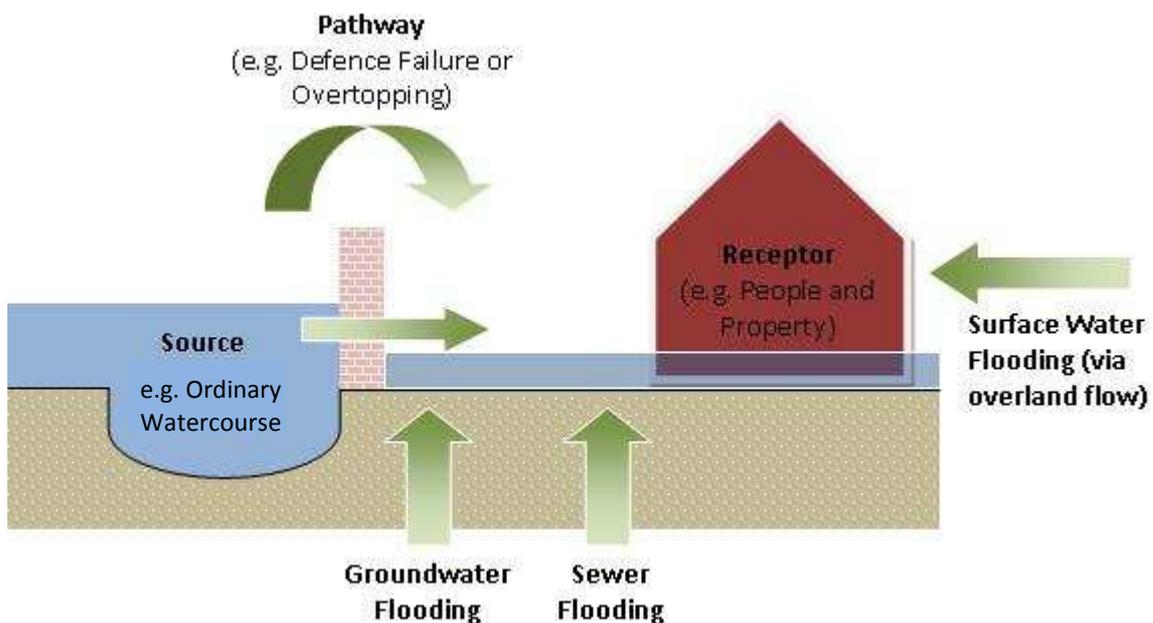
The Preliminary Flood Risk Assessment is a high level summary of flood risk based on available and readily derivable information, describing both the probability and harmful consequences of past and future flooding. The assessment will identify areas where the risk of flooding is considered to be significant and requires further assessment through the production of flood risk and flood hazard maps and flood risk management plans.

The approach for compiling this PFRA has been based on the procedural requirements of the Environment Agency’s guidance ‘Preliminary Flood Risk Assessment (PFRA) Final Guidance’ (December 2010).

3.2 Methodology

Flood risk within this PFRA will be considered using the Source → Pathway → Receptor Risk Model. Flood risk is generally accepted to be a combination of the likelihood of flooding and the potential consequences arising from this, Figure 3.2 below identifies the model; it should be remembered that flood risk can occur from many different sources and pathways and not simply those shown in the simple form below.

Figure 3.2: Source → Pathway → Receptor Model





Data Collection from Partner Organisations

The following appropriate authorities have contributed data to allow the preparation of this PFRA:

- South Tyneside Council;
- Environment Agency;
- Tyne and Wear Fire & Rescue Service;
- Northumbria Police;
- Northumbrian Water Limited;
- Highways Agency;
- Network Rail.
- Nexus

Assessing Historic Flood Risk

Existing datasets, reports and anecdotal information from the stakeholders listed above were collated and reviewed to identify details of major past flood events and consequences including economic damage, environmental and cultural consequences and impacts on the local population.

Where this information was geo-referenced it was incorporated into South Tyneside Councils GIS software to allow the identification of historic flood events to be compared with receptor data to assess the overall level of flood risk.

Assessing Future Flood Risk

The PFRA must contain an assessment of potential future flood risk, defined as any flood that could potentially occur in the future. Within this PFRA nationally produced datasets will be used to assess potential flood risk, the following datasets will be utilised:

- Flood Map for Surface Water (FMfSW), the dataset used will be the 1 in 200 rainfall event, with 0.3m depth banding.
- Areas Susceptible to Groundwater Flooding, this is a broad scale map showing groundwater flood areas on a 1km² grid. This dataset covers consolidated aquifers and permeable superficial deposits and shows the proportion of each 1km grid square susceptible to flooding.

The following factors were considered when assessing future flood risk across the South Tyneside study area: topography, location of ordinary watercourse, characteristics of watercourse (lengths, modifications), effectiveness of any works constructed for the purpose of flood risk management, location of populated areas, areas in which economic activity is concentrated, the current and predicted impact of climate change and the

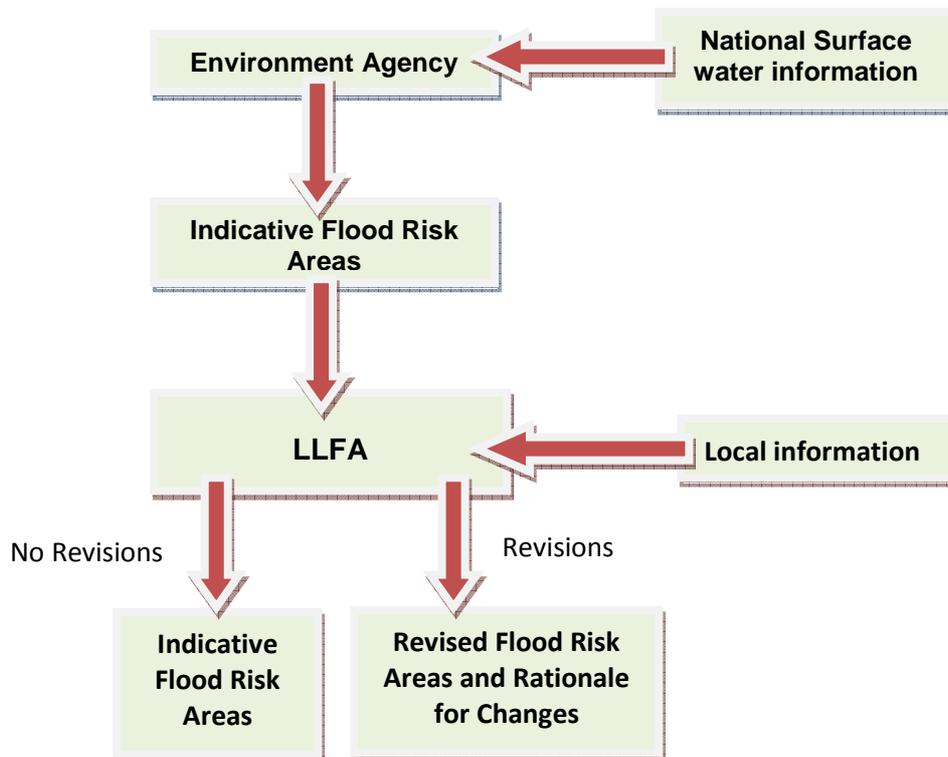


predicted impact of any long-term developments that might affect the occurrence or significance of flooding, such as proposals for future development.

Identifying Flood Risk Areas

The Regulations require LLFAs to determine whether there is a significant flood risk in their area based on local flooding and to identify the part of the area affected by the risk. The Environment Agency have derived Indicative Flood Risk Areas across England, these are based on national surface water information and nationally derived significance criteria. Each LLFA must review these Indicative Flood Risk Areas with reference to local information and suggest amendments or state their agreement with the nationally derived areas. The following diagram (Figure 3.3) summarises the PFRA process:

Figure 3.3: Assessing Flood Risk Areas





3.3 Data Sources

Table 3.3 identifies the relevant information and datasets held by South Tyneside Council and other appropriate authorities that will be drawn on as part of the preliminary assessment report.

	Dataset	Description
Environment Agency	Flood Map for Surface Water (FMfSW)	Updated (second generation) national surface water flood mapping which was released at the end of 2010. This dataset includes two flood events (1 in 30 and 1 in 200 chance of occurring) and two depth bandings (greater than 0.1m and greater than 0.3m).
	Flood Map (Rivers and the Sea)	Shows the extent of flooding from rivers with a catchment of 3km ² and from the sea.
	Areas Susceptible to Groundwater Flooding	Course scale national mapping showing areas which are susceptible to groundwater flooding.
	Indicative Flood Risk Areas	Nationally identified flood risk areas, based on the definition of 'significant' flood risk described by DEFRA and WAG.
	Historic Flood Map	Attributed spatial flood extent data for flooding from all sources.
	Northumbria Catchment Flood Management Plan	CFMPs consider all types of inland flooding, from rivers, groundwater, surface water and tidal flooding and are used to plan and agree the most effective way to manage flood risk in the future.
South Tyneside Council	Strategic Flood Risk Assessments (SFRA)	SFRAs contain useful information on historic flooding, including local sources of flooding from surface water, groundwater and ordinary watercourses.
	Historical flooding records	Local Authority Historical Flooding Records.
	Local Land and Property Gazetteer	Local Authority Records of addresses and premises type.



Tyne & Wear Fire & Rescue	Historic flooding records	Historic records of flooding from Tyne and Wear Fire and Rescue Service call out and operation logs.
Northumbria Police	Historic flooding records	Historic records of flooding within South Tyneside from Northumbria Police from call out logs.
Northumbrian Water	DG5 Register	Northumbrian Water DG5 register.
Highways Agency	Historical flooding records	Highways Agency historical flood records
Network Rail	Historical flooding records	Network Rail historical records of flooding.
Nexus	Nil Response	

3.4 Data Limitations

As identified above, a number of organisations hold data on historical flooding incidents; this is gathered, recorded and stored to significantly different levels. It is recognised that this information is often fit for purpose for the particular organisation collecting and holding the data, however it must be recognised that the intended purpose of the data is often not to contribute to flood risk assessments, such as this PFRA.

It is important to recognise the limitations in data quality to understand any assumptions that will reflect on this PFRA and to recognise those areas where improvements may be made in the future. A number of issues are identified below:



Inconsistent Recording

Historic Flooding data has been gathered from a range of organisations; this has been collected and recorded in an inconsistent manner across, and within, organisations. This has resulted in incomplete datasets where the precise location and extent of flooding is unknown.

Incomplete Datasets

Some of the datasets collected are not exhaustive and it is felt that they may not accurately represent complete flood risk within South Tyneside. The gaps in flood data may hinder the identification of accurate flood risk areas.

Varied Quality of Data

As previously identified, there were found to be variances in the quality of historic flood records and information held by authorities. It has also been noted that within South Tyneside Council arrangements for recording flooding incidents are different across departments (for example, Highways, South Tyneside Homes and Environmental Health) and may often depend on how individual officers record information. The current arrangements will need to be assessed in the future with the aim of standardising information.

Records of Consequences of Flooding

Very limited information is available regarding the consequence of past flood events, any information regarding past consequences was often limited in scope. The lack of information may have made the assessment of historic flooding inaccurate.

Interpretation of Data

Due to data being collected by organisations for their own purposes, and often in an inconsistent manner, a degree of interpretation has had to be taken on the recorded flooding incidents. Where interpretation of the data has been necessary this has been done through the use of local knowledge and the exclusion of data which was substantially incomplete.

Reporting Periods

Data has been collected over a different number of years for each reporting organisation; this may have lead to flooding incidents not having been reported and an underestimation of flood risk on historic flood risk mapping.



Duplication of Data

It may be possible that a number of organisations may have reported the same flooding incident. Particular flooding incidents or locations may therefore appear to be more vulnerable to flooding on historic flood risk mapping.

3.5 Quality Assurance, Security and Data Restrictions

A summary table illustrating the restrictions of the use of this data is included in Table 3.5 below:

Table 3.5. Summary of data restrictions and licensing details	
Environment Agency	The use of some data is restricted to South Tyneside Council for the preparation of its Preliminary Flood Risk Assessment.
Northumbrian Water	The use of some data is restricted to South Tyneside Council for the preparation of its Preliminary Flood Risk Assessment.
Northumbria Police	The use of some data is restricted to South Tyneside Council for the preparation of its Preliminary Flood Risk Assessment.
Tyne and Wear Fire and Rescue Service	The use of some data is restricted to South Tyneside Council for the preparation of its Preliminary Flood Risk Assessment.
Highways Agency	The use of some data is restricted to South Tyneside Council for the preparation of its Preliminary Flood Risk Assessment.
Network Rail	The use of some data is restricted to South Tyneside Council for the preparation of its Preliminary Flood Risk Assessment.
Nexus	Nil Response.



4.0 Historic Flood Risk

4.1 Overview of historic flooding within South Tyneside

Details of historic flooding incidents across South Tyneside have been collated from the sources identified in Table 3.3. A summary map identifying locations of these past flood events is included as Figure 4.1, below. The collated data comes from a number of sources and has been collected to differing degrees of accuracy. It may be entirely plausible that flooding of a significant local effect may have occurred but has not been recorded by any of these means. A summary of information specific to each source of flooding considered as part of the PFRA is considered below:

Surface Water Flooding

Surface water flooding occurs when the level of rainfall overwhelms the capacity of the drainage system causing water to flow across the ground. Information on known or likely historic surface water flooding was obtained from a variety of sources, as identified in Table 3.3. Key sources of Surface Water were recorded by South Tyneside Council, Northumbria Police, Highways Agency and the Tyne and Wear Fire and Rescue Service.

The degree to which surface water flooding has been recorded in South Tyneside is limited, some historic flood information contains limited flood extent information such as estimates of depths and extent of flooding. The majority of this information is however limited to the date and time of the flooding incident with limited accuracy regarding the precise location of the flooding event.

Groundwater Flooding

Groundwater flooding occurs as a result of water rising up from the underlying aquifer or from water flowing from abnormal springs. This tends to occur after long periods of sustained and heavy rainfall, and the areas at most risk are often low-lying where the water table is more likely to be at shallow depth. Groundwater flooding is known to occur in areas underlain by major aquifers, although increasingly it is also being associated with more localised floodplain sands and gravels.

The underlying geology and soils data for South Tyneside was reviewed using strategic scale (1:250,000) mapping. The soils map for the area is available from the National Soil Research Institute: <http://www.landis.org.uk/soilscapes/>. According to the soils map the South Tyneside area is generally underlain by slowly permeable clay soils that tend to impede natural drainage. During periods of heavy rainfall the subsoil tends to become waterlogged.

There is no evidence of historic groundwater flooding occurring within South Tyneside.



Sewer Flooding

Sewer flooding is often caused by excess surface water entering the sewerage network. There may be occasions where blockages occur in the sewerage network due to physical obstructions (such as lack of maintenance, collapse or mistreatment) that may cause surcharging of the sewerage network, these types of situation will not be considered as part of this PFRA. Northumbrian Water hold a register of the number of properties reported to have been affected by flooding either internally, or externally; this register is known as a DG5 register. The sewer flooding events from Northumbrian water have not been geo-referenced so no comment can be made by their spatial extent and distribution. In addition, once a property is identified on the water companies DG5 register, it typically means that the water company can put funding into place to take properties off the register.

Ordinary Watercourse Flooding

The river Don runs through South Tyneside, this river is primarily Main River, however some of the upper reaches of the river are classed as Ordinary Watercourse. While there are some records of flooding on the upper reaches of the Don classified as Main River, South Tyneside Council are not aware of any flooding incidents on those areas classified as Ordinary Watercourse.

Interaction with Main Rivers and the Sea

Insufficient data is available to draw a definitive conclusion as to whether there were any interactions with sources of flooding under consideration in this PFRA and other sources such as Main Rivers or the Sea.

4.2 Analysis of Historic Flooding within South Tyneside

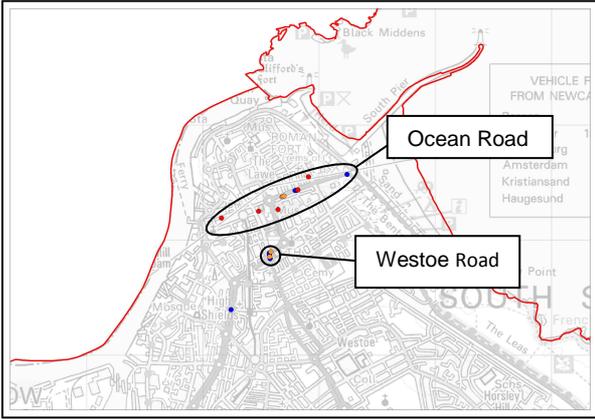
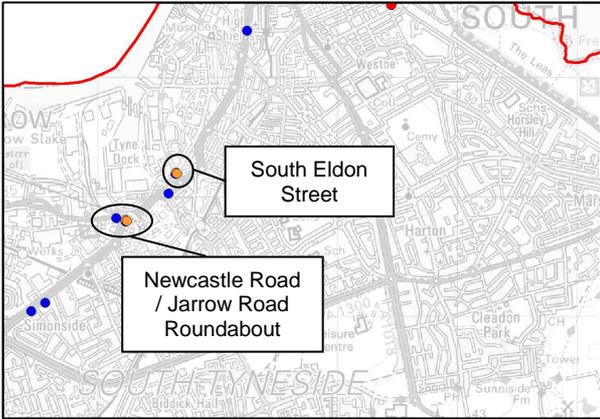
Historical Flooding records from South Tyneside Council, Northumbria Police, Network Rail, Tyne and Wear Fire and Rescue and Highways Agency have been identified. It is possible that other historical flooding data exists within other organisations; however this has not been made available in time for consideration in this PFRA. A breakdown of flooding records has been provided in Table 4.2 below:

Table 4.2. Historic Flooding Records	
Organisation	Number of Reported Flooding Incidents
South Tyneside Council	33
Northumbria Police	87
Tyne and Wear Fire and Rescue Service	26
Highways Agency	6
Total	152



Figure 4.1 identifies the distribution of historic flooding records identified in Table 4.2, above. A total of 152 flooding records have been analysed to try and gain a further understanding of flood risk in South Tyneside.

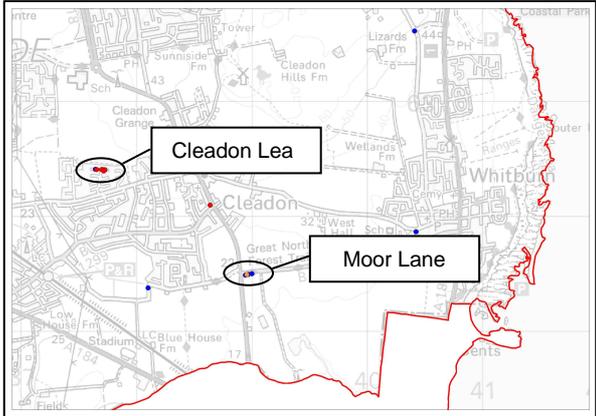
There are a number of areas where reported flooding incidents have occurred on a frequent basis; these are outlined in Table 4.3, below:

Table 4.3 – Distribution of historic flooding records	
<p>South Shields Town Centre</p> <p>Ocean Road – 7 reported historic flood events.</p> <p>Westoe Road – 5 reported historic flood events.</p>	
<p>South Shields</p> <p>South Eldon Street – 3 reported historic flood events.</p> <p>Newcastle Road / Jarrow Road Roundabout – 4 reported historic flood events.</p>	



<p>Jarrow</p> <p>Church Bank / Straker Street – 9 reported historic flood events.</p> <p>Lindisfarne Roundabout and adjacent A194 – 19 reported historic flood events.</p> <p>York Avenue / Calf Close Lane – 7 reported historic flood events.</p>	
<p>Hebburn</p> <p>Lukes Lane – 7 reported historic flood events.</p> <p>Campbell Park Estate – 4 reported historic flood events.</p>	
<p>Boldon</p> <p>Testos Roundabout / A19 – 13 reported historic flood events.</p> <p>Reay Crescent – 4 reported historic flood events.</p>	



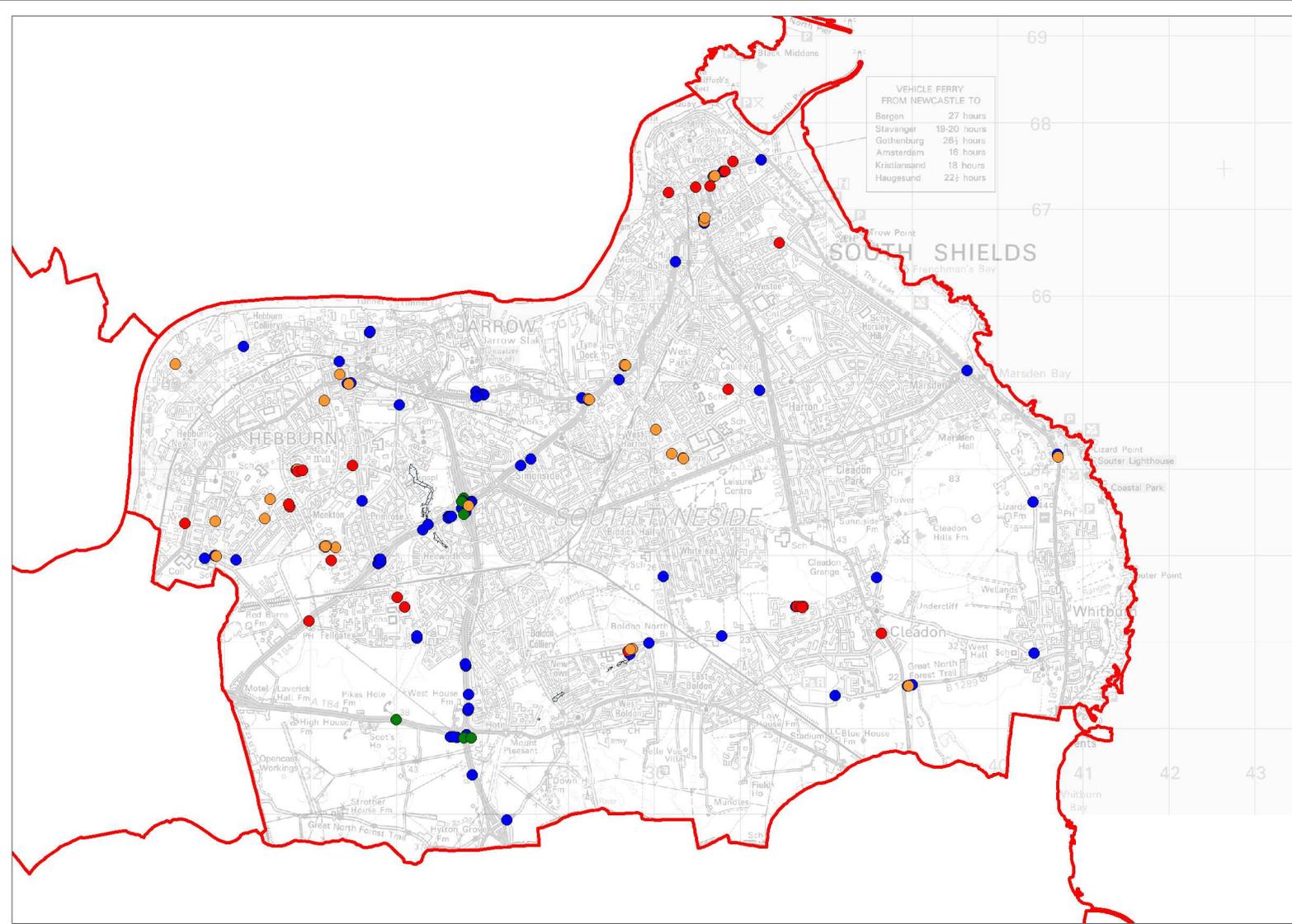
<p>Cleadon</p> <p>Cleadon Lea – 7 reported historic flood events.</p> <p>Moor Lane – 4 reported historic flood events.</p>	 <p>The map shows the Cleadon area with a red outline indicating the flood risk boundary. Two specific locations are highlighted with red dots and labeled: Cleadon Lea and Moor Lane. The map includes various landmarks and street names such as Cleadon Grange, Cleadon Hills Fm, Wellands Fm, Great North, and Moor Lane.</p>
---	---

4.3 Consequences of Historic Flooding

While there is notable evidence of historical flooding within South Tyneside there is insufficient data available to draw any definitive conclusions regarding the impact and consequences of historic flood events on people, the economy and the environment.

Due to the lack of satisfactory information, no historic flood events are considered to have 'significant harmful consequences' and therefore none will be recorded in Annex 1 of the Preliminary Assessment Spreadsheet. South Tyneside Council acknowledge that insufficient information has been recorded to accurately identify areas impacted by historic flooding; the reasons for this have been previously outlined in Section 3.4. It is appreciated that information on historic flooding is important for understanding and managing future flood risk, South Tyneside Council therefore intends to build upon the information recorded during flooding incidents.

A selection of photographs has been included in Annex 5. These highlight a number of historic flood events within South Tyneside, despite none being considered to have significant harmful consequences based on available information.



Historic Flooding Records by Organisation

- Highways Agency (or appointed agents) (6)
- Police (87)
- South Tyneside Council (33)
- Tyne and Wear Fire and Rescue Service (26)

- Environment Agency
Historic Flooding Incidents

Historic Flooding Incidents - South Tyneside

Figure 4.1

Scale: 1 to 15,000

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5.0 Future Flood Risk

5.1 Overview of Future Flood Risk

Surface Water Flooding

No local information is currently available in connection to surface water flood risk in South Tyneside; the study will therefore utilise national mapping datasets to assess future flood risk.

The Environment Agency has produced a national assessment of surface water flood risk in the form of two national mapping datasets:

- Areas Susceptible to Surface Water Flooding (AStSWF), this contains three susceptibility bandings for a rainfall event with a 1 in 200 chance of occurring.
- Flood Map for Surface Water (FMfSW), is the latest revision of the model containing two flood events (1 in 30 annual chance and 1 in 200 annual chance) and two depth bandings (greater than 0.1m and greater than 0.3m).

It is believed that the Flood Map for Surface Water (FMfSW) is more representative of surface water flood risk within South Tyneside, it is believed that assumptions regarding the built environment which have been taken into account in this revision are appropriate (i.e. inclusion of sewer flow, infiltration rates, storm duration and building outlines).

While the Environment Agency's surface water flood maps give a general indication of broad areas likely to be at risk from surface water flooding, the maps are not suitable for identifying whether an individual property will flood. Flood maps identify areas at risk of flooding where surface water flooding is strongly influenced by topography.

The maps show areas that are likely to flood in storms with a 1 in 200 and 1 in 30 chance of occurring in any year. For each storm, the map shows areas which are likely to a greater depth than 0.1m and areas which are likely to experience deeper flooding, greater than 0.3m.

It is believed that the 1 in 200 rainfall event is likely to be more appropriate for this Preliminary Flood Risk Assessment; this will assess the rarer surface water flood events and is equivalent to flooding on the ground in order of 1 in 100 (i.e. there is a chance of the 1 in 200 year rainfall event not resulting in flooding). It is also believed that the 0.3m deep flooding event may be more appropriate to identify where flood depth and where its impact on properties may be more significant.

Using this dataset the number of properties at risk of surface water flooding within South Tyneside has been estimated. For a rainfall event with a 1 in 200 chance of occurring,



approximately 4000 residential and 100 business (or critical services) properties are at risk from flooding to a depth of 0.3m. Further details of the potential harmful consequences of future flooding are included in Annex 2 of the Preliminary Assessment Spreadsheet.

Table 5.1 includes a comparison of the estimated number of residential properties at risk of surface water flooding across South Tyneside.

Table 5.1. Residential Properties at risk from surface water flooding	
Location	Estimated number of properties at risk of surface water flooding ^a <i>[flooding to a depth of 0.3m from an event with a 1 in 200 annual chance of occurring]</i>
South Shields	2000
Hebburn	900
Jarrow	500
Whitburn, Cleadon and Boldon	600
All South Tyneside	4000

^a Property counts rounded to the nearest 100 properties

Groundwater Flooding

There is no locally available data which provides evidence on future groundwater flood risk across South Tyneside. The Environment Agency’s national dataset, Areas Susceptible to Groundwater Flooding, has been used to form the basis of the assessment of future flood risk from groundwater. This dataset shows potential areas susceptible to groundwater flooding on a 1km² grid that identifies at a broad scale areas susceptible to flooding from groundwater on the basis of geological and hydrological conditions. It does not show the likelihood of groundwater flooding occurring and therefore is a hazard based (not risk-based) dataset. It does not take account of areas where groundwater is likely to pond or flow, but simply considers where groundwater might emerge. Hazard is represented by one of four area categories showing the proportion of each 1 km² that is susceptible to groundwater flood emergence:

- <25%
- >=25% to <50%
- >=50% to <75%
- >=75%

The grid squares within South Tyneside showing potential areas susceptible to groundwater flooding are identified in Figure 5.1, below.



Ordinary Watercourses

There is no available information on future flood risk from Ordinary Watercourses within South Tyneside. The Detailed River Network was used to identify ordinary watercourses and this was cross referenced with the Flood Map for Rivers and Sea to assess future flood risk from this source. Based on this methodology, no areas were identified that seemed to be at significant risk from ordinary watercourses within South Tyneside.

5.2 Locally Agreed Surface Water Information

Locally agreed surface water information has been considered for what best represents local conditions in South Tyneside.

As there is no local information on future flooding available, the locally agreed surface water information is the Flood Map for Surface Water dataset, which gives an overview of the future flood risk from surface water across South Tyneside. This dataset is illustrated in Figure 5.2.

5.3 Potential Consequences of Future Flooding

The Environment Agency have used the Flood Map for Surface Water to identify a number of areas across the country that exceeds a given threshold, described in Table 5.3 below:

Table 5.3: Flood Risk Threshold used to Identify Future Consequences of Flooding	
'Significant harmful consequences' defined as greater than...	Description
200 people <i>or</i>	<i>Flooded to a depth of 0.3m during a rainfall event with a 1 in 200 chance of occurring (or 0.5%)</i>
20 businesses <i>or</i>	
1 critical service	

Note:

The definitions of significant harmful consequences used in this PFRA have been based on those used by the Environment Agency in their assessment of significant local flood risk. South Tyneside Council has not been able to consult widely on the definition of significance and its local relevance within South Tyneside.

It is proposed that South Tyneside Councils Local Flood Risk Strategy will consider the definition of significant harmful consequences in further detail, once this consultation has taken place the local definition of significance will be used in future flood risk work and future revisions of the Preliminary Flood Risk Assessment.



This assessment was carried out based on 1km² national grid squares, and the grid squares that exceed this criterion were identified. The grid squares within South Tyneside where flood risk is considered to exceed this threshold are illustrated in Figure 5.3, below. These areas represent where flood risk is considered to be the most severe across South Tyneside.

The potential consequences on key flood risk indicators (identified in Table 5.4) have been assessed by the Environment Agency; this information has been included in Annex 2 of the Preliminary Assessment Spreadsheet.

Table 5.4: Key Flood Risk Indicators	
Impacts of flooding on:	Flood Risk Indicators
Human Health	Number of residential properties. Critical services (Hospitals, Police/Fire/Ambulance Stations, Schools, Nursing Homes etc).
Economic Activity	Number of non-residential properties. Length of road or rail. Area of agricultural land.
Cultural Heritage	Cultural Heritage sites (World Heritage Sites).
Environment	Designated sites (SSSIs, SACs, SPAs, etc) BAP habitat.

5.4 Climate change and long term developments

The Evidence

There is clear scientific evidence that global climate change is happening now. It cannot be ignored.

Over the past century around the UK we have seen sea level rise and more of our winter rain falling in intense wet spells. Seasonal rainfall is highly variable. It seems to have decreased in summer and increased in winter, although winter amounts changed little in the last 50 years. Some of the changes might reflect natural variation; however the broad trends are in line with projections from climate models.

Greenhouse gas (GHG) levels in the atmosphere are likely to cause higher winter rainfall in future. Past GHG emissions mean some climate change is inevitable in the next 20 – 30 years. Lower emissions could reduce the amount of climate change further into the future, but changes are still projected at least as far ahead as the 2080s.

We have enough confidence in large scale climate models to say that we must plan for change. There is more uncertainty at a local scale but model results can still help us plan to adapt. For example we understand rain storms may become more intense, even if we can't be sure about exactly where or when. By the 2080s, the latest UK climate projections (UKCP09) are that there could be three times as many days in winter with



heavy rainfall (defined as more than 25mm in a day). It is plausible that the amount of rain in extreme storms (with a 1 in 5 annual chance, or rarer) could increase locally by 40%.

Key Projections for Northumbria River Basin District

If emissions follow a medium future scenario, UKCP09 projected changes by the 2050s relative to the recent past are:

- Winter precipitation increases of around 10% (very likely to be between 0 and 23%)
- Precipitation on the wettest day in winter up by around 11% (very unlikely to be more than 24%)
- Relative sea level at Tynemouth very likely to be up between 7 and 38cms from 1990 levels (not including extra potential rises from polar ice sheet loss)
- Peak river flows in a typical catchment likely to increase between 8 and 13%

Increases in rain are projected to be greater nearer the coast than inland.

Implications for Flood Risk

Climate change can affect local flood risk in several ways. Impacts will depend on local conditions and vulnerability.

Wetter winters and more of this rain falling in wet spells may increase river flooding in both rural and heavily urbanised catchments. More intense rainfall causes more surface runoff, increasing localised flooding and erosion. In turn, this may increase pressure on drains, sewers and water quality. Storm intensity in summer could increase even in dryer summers, so we need to be prepared for the unexpected.

Rising sea or river levels may increase flood risk inland or away from major rivers because of interactions with drains, sewers or smaller watercourses.

Where appropriate, we need local studies to understand climate impacts in detail, including effects from other factors like land use. Sustainable development and drainage will help us adapt to climate change and manage the risk of damaging floods in future.

Adapting to Change

Past emission means some climate change is inevitable. It is essential we respond by planning ahead. We can prepare by understanding our current and future vulnerability to flooding, developing plans for increased resilience and building the capacity to adapt. Regular review and adherence to these plans is key to achieving long term sustainable benefits.



We will therefore consider a range of measures and retain flexibility to adapt. This approach, embodied within flood risk appraisal guidance, will help to ensure that we do not increase our vulnerability to flooding.

Long term developments

It is possible that long term developments might affect the occurrence and significance of flooding. However current planning policy aims to prevent new development from increasing flood risk.

In England, Planning Policy Statement 25 (PPS25) on development and flood risk aims to "ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk. Where new development is, exceptionally, necessary in such areas, policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall."

Adherence to Government policy ensures that new development does not increase local flood risk. However, in exceptional circumstances the Local Planning Authority may accept that flood risk can be increased contrary to Government policy, usually because of the wider benefits of a new or proposed major development. Any exceptions would not be expected to increase risk to levels which are "significant" (in terms of the Government's criteria).



South Tyneside Council

South Tyneside Boundary



Areas Susceptible to Groundwater Flooding

- < 25%
- >= 25% < 50%
- >= 50% < 75%
- >= 75%

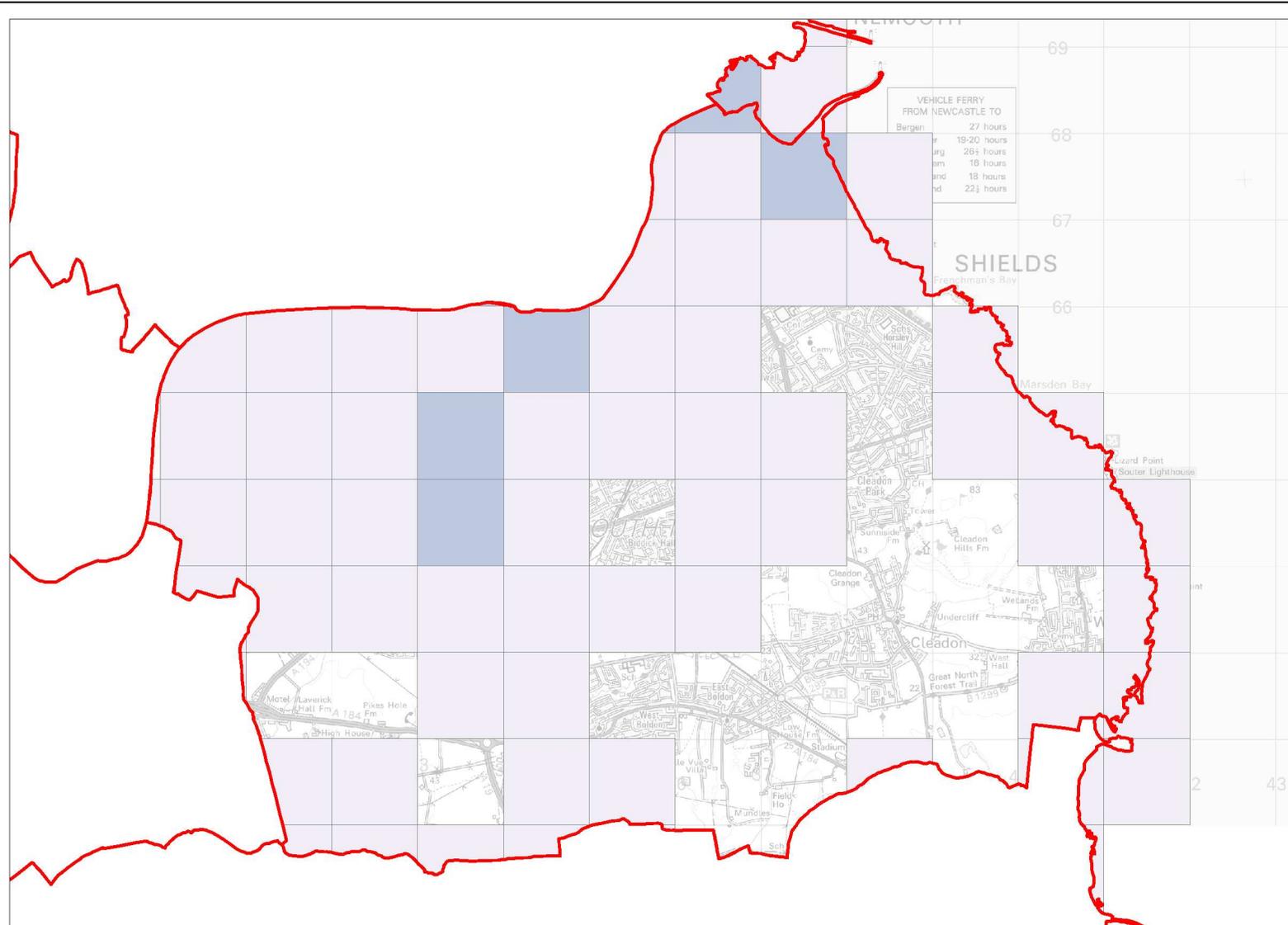
South Tyneside Council PFRA

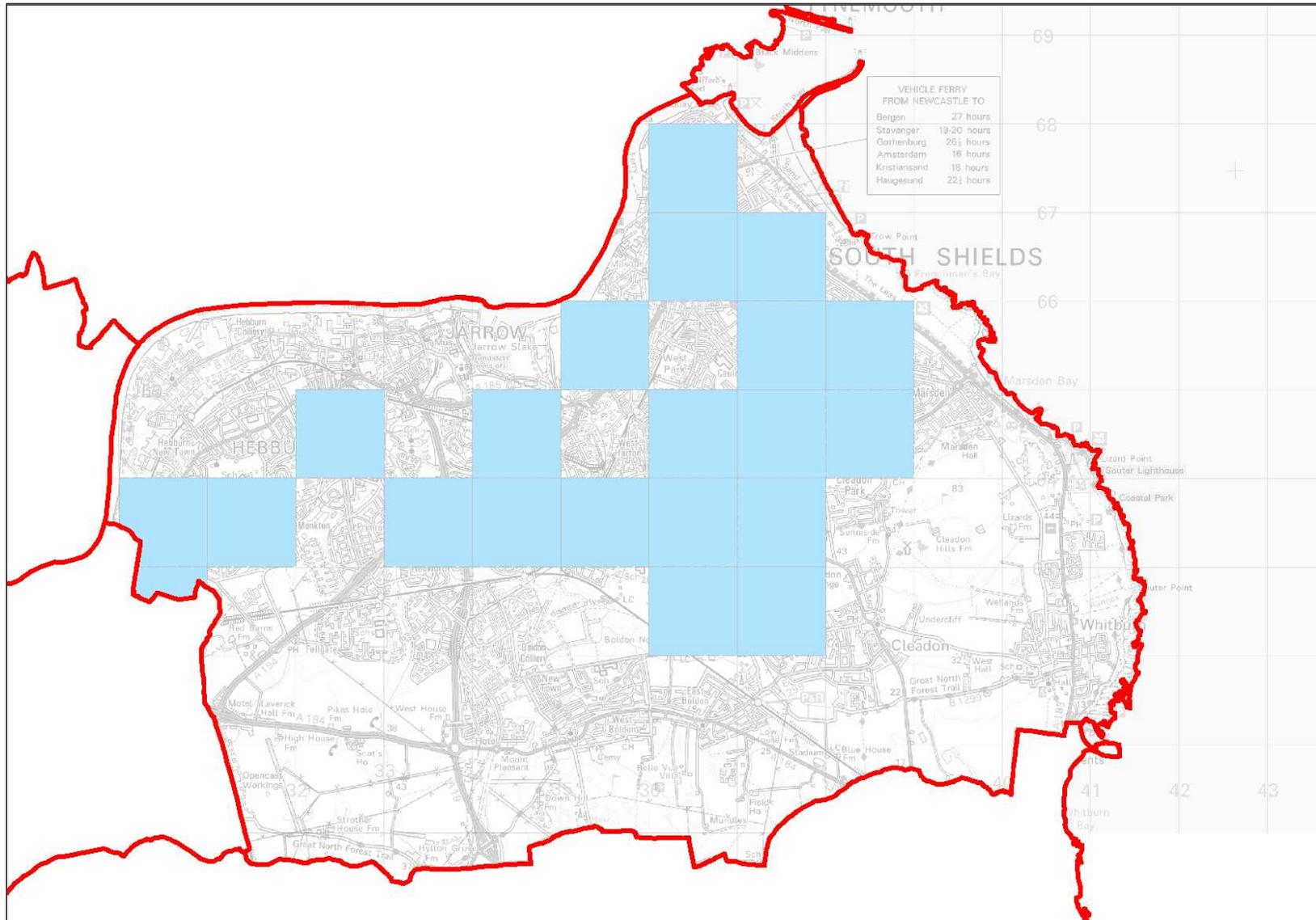
Areas Susceptible to Groundwater Flooding

Figure 5.1

Scale: 1 to 15,000

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South Tyneside Council

South Tyneside Boundary



Areas Above Flood Risk Threshold



Places above Flood Risk Thresholds are 1km grid squares where at least one of the following flood risk indicators is above the threshold given below:

1. Number of people >200.
2. Critical Services >1.
3. Number of non-residential premises >20.

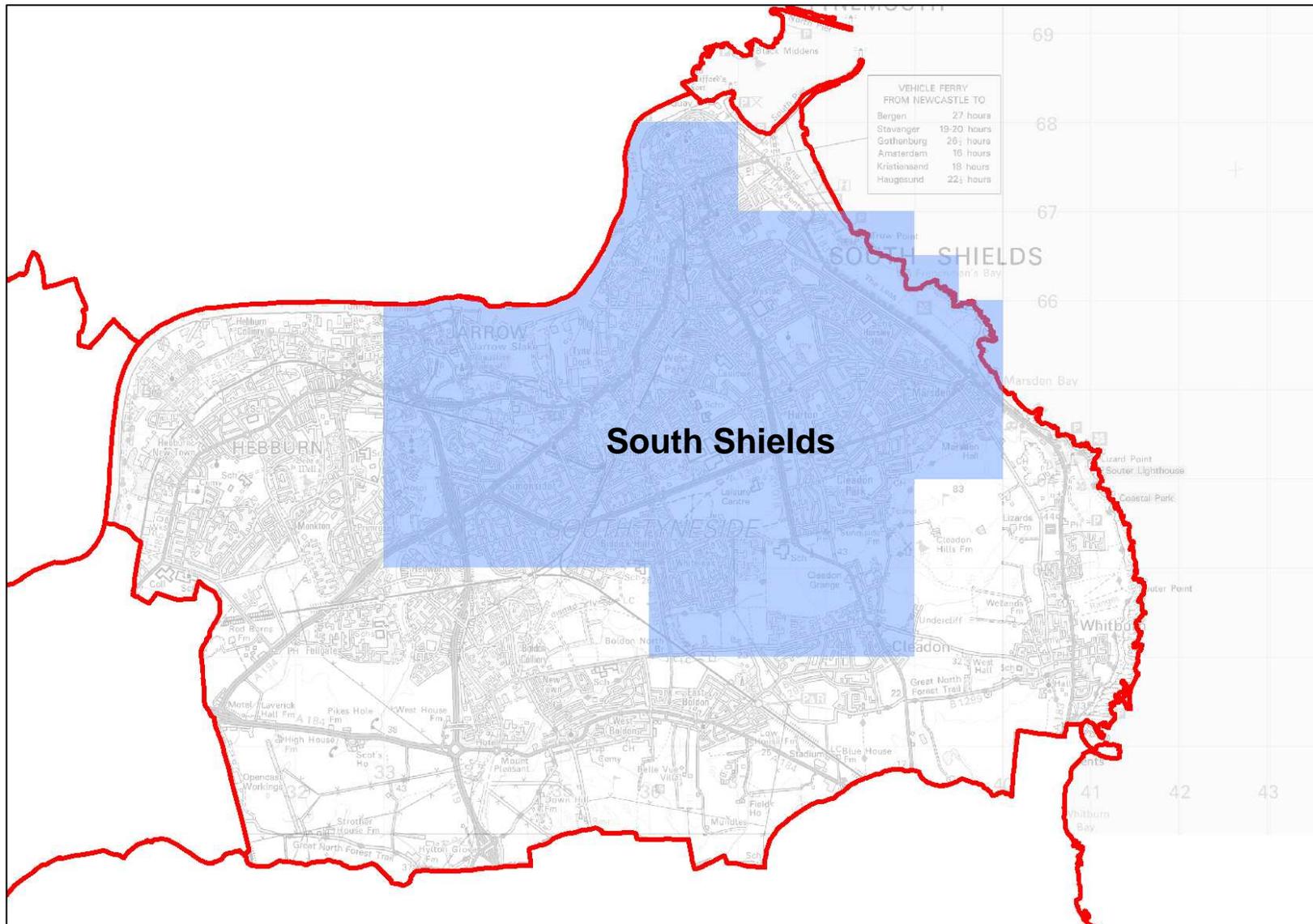
Indicators calculated using South Tyneside Council LLPG and Flood Map for Surface Water (deep, 1 in 200 annual probability rainfall).

Areas above Flood Risk Threshold

Figure 5.2

Scale: 1 to 15,000

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South Tyneside Council

- South Tyneside Boundary
- South Shields Cluster

Clusters are formed from all 3km squares that contain 5 or more places above the Flood Risk Thresholds (1km squares) that are touching.

Places above Flood Risk Thresholds are 1km grid squares where at least one of the following flood risk indicators is above the threshold given below:

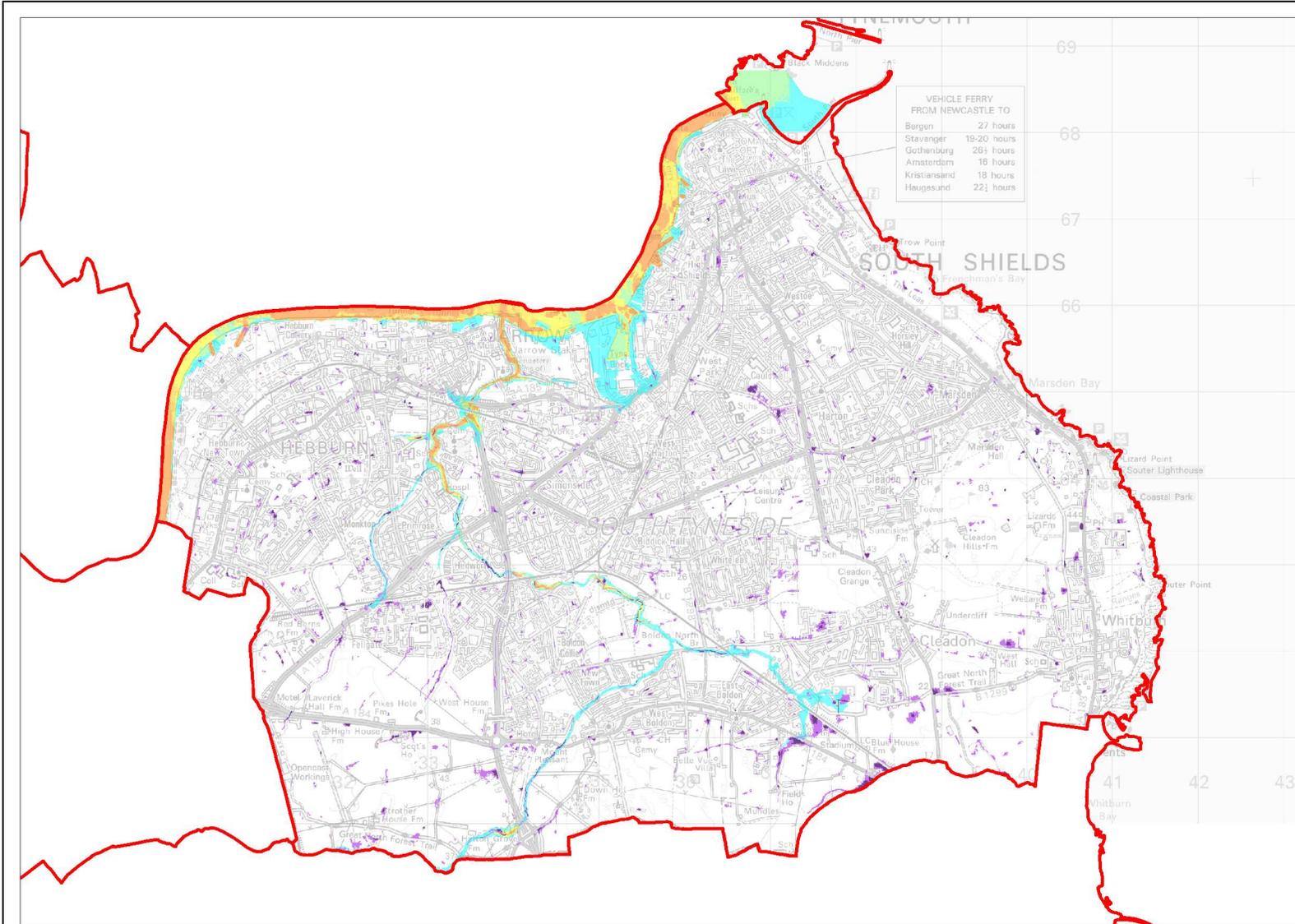
4. Number of people >200.
5. Critical Services >1.
6. Number of non-residential premises >20.

Indicators calculated using South Tyneside Council LLPG and Flood Map for Surface Water (deep, 1 in 200 annual probability rainfall).

Flood Map for Surface Water Cluster
Figure 5.3

Scale: 1 to 15,000

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South Tyneside Boundary



Surface Water 'Deep'



Surface Water 'Shallow'



Flood Map for Surface Water

(1 in 200 annual chance)

Figure 5.4

Scale: 1 to 15,000

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6.0 Flood Risk Areas

6.1 Overview

National guidance has been issued by DEFRA identifying criteria for assessing whether flood risk is significant, as required by regulation 14 of the Flood Risk Regulations (2009). The guidance document 'Selecting and reviewing Flood Risk Areas for local sources of flooding' (DEFRA, 2010).

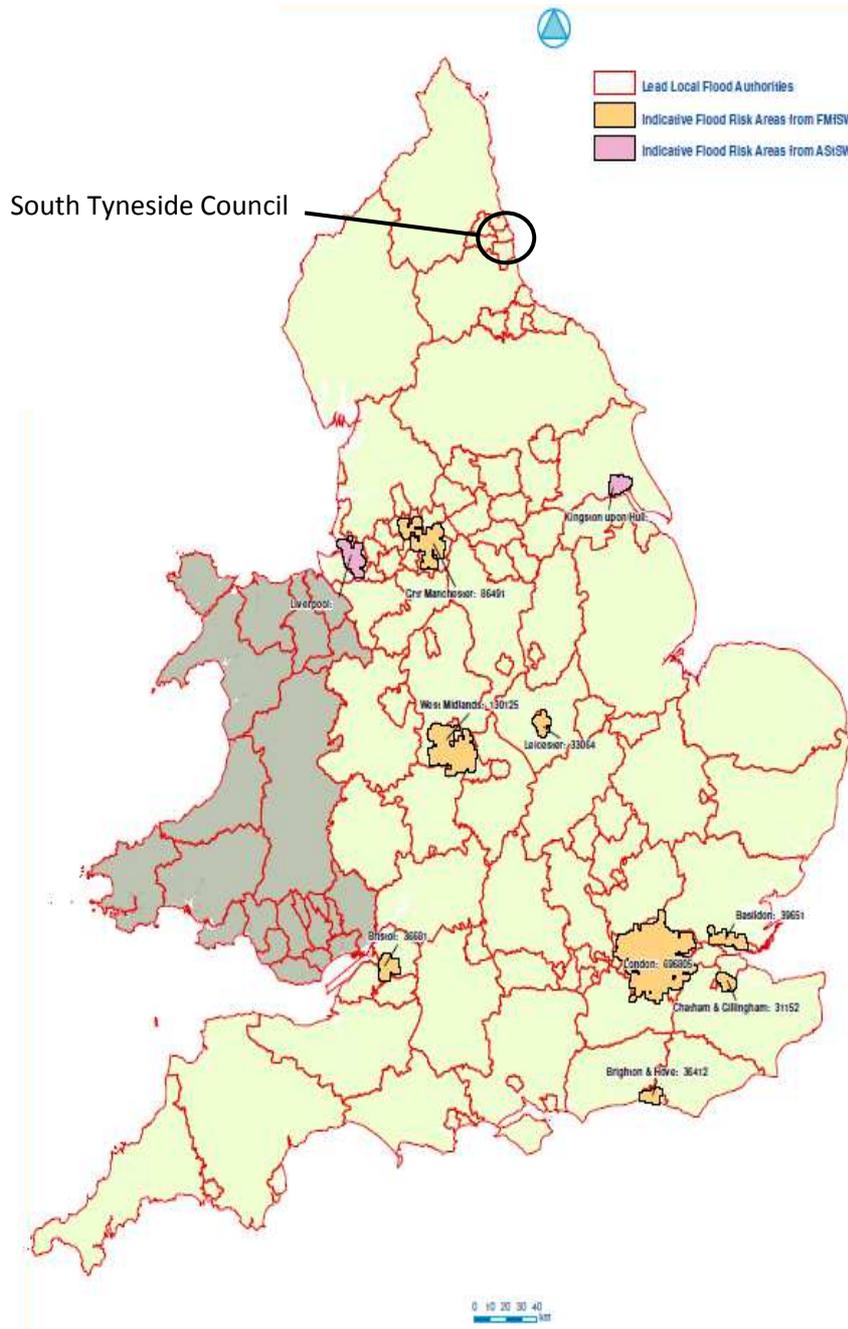
The criteria for assessing significance are outlined in Table 6.1, below. Indicative Flood Risk Areas have been identified, drawing on national flood risk information to identify 1 kilometre grid squares where local flood risk is an issue. Where many grid squares are close together (clustered) and the risk is most concentrated, these clusters are identified as an indicative Flood Risk Areas. The indicative Flood Risk Areas are meaningful areas in which the magnitude of the flood risk in a national context justifies further investigation through maps and management plans, as required by the Flood Risk Regulations (2009) and the results reported to the European Commission.

Table 6.1: National Indicators and Threshold Values to determine Flood Risk Areas		
Area Designation	Indicators	Threshold
Human Health		
Indicative Flood Risk Areas	Number of People (based on number of residential properties x 2.34)	Set at 30,000 within a cluster where risk is most concentrated.
Indicative Flood Risk Areas	Critical Services (including schools, hospitals, nursing homes, power and water services)	"Nominal threshold" 150, although number of people is the deciding threshold for indicative Flood Risk Areas.
Economic Activity		
Indicative Flood Risk Areas	Non-residential properties (including shops and businesses)	"Nominal threshold" of 3,000 although number of people is the deciding threshold for indicative Flood Risk Areas.

The Indicative Flood Risk Areas have been issued to Lead Local Flood Authorities for consideration. South Tyneside Council has reviewed these Indicative Flood Risk Areas, drawing on the local flood risk information in the preliminary assessment report. Figure 6.1, below, identifies the ten national Indicative Flood Risk Areas, none of these falls within South Tyneside. On consideration of the information contained in the preliminary risk assessment (Sections 1.0 to 5.0 of this report), South Tyneside Council is in agreement that there are no significant Flood Risk Areas within its administration area.



Figure 6.1: Map of Indicative Flood Risk Areas





7.0 Next Steps

7.1 Future Preliminary Flood Risk Assessment Requirements

This Preliminary Flood Risk Assessment has confirmed that there are no 'significant flood risk areas' in relation to surface water, groundwater and ordinary watercourses within South Tyneside. Accordingly, there is no requirement to proceed towards producing Flood Hazard Maps and Flood Risk Maps or to prepare Flood Risk Management Plans. The next requirement for South Tyneside Council will be to review this PFRA as part of the second cycle in 2017.

7.2 Future Data Management Arrangements

South Tyneside Council has a number of existing and emerging responsibilities as a Lead Local Flood Authority. It is understood that an evidence base will be required to comply with all these new duties. South Tyneside Council has a significant amount of data in relation to Flood Risk Management, some of this being locally derived and some from national datasets. It is considered that future data management and reporting arrangements will have to be increased to meet these emerging responsibilities.

7.3 Scrutiny and Review Procedures

The scrutiny and review procedures that must be adopted when producing a PFRA are set out by the European Commission. The scrutiny and review procedure will comprise two key steps, as identified below.

Local Authority Review

The first part of the review procedure is through a process of internal Local Authority review, in accordance with internal procedures. The Flood and Water Management Act (2010) extended the remit of Local Authority Scrutiny to cover flood risk management in line with new duties placed on Lead Local Flood Authorities.

South Tyneside Council held a Scrutiny Commission on Flood Risk in September 2009, in relation to the recommendations of the Pitt Review. A full scrutiny process focusing on flood risk management within South Tyneside was conducted, following the scrutiny commission a report was produced with relevant recommendations; the scrutiny process will be followed up by an annual summary. The PFRA will feed into this annual review process at the next available opportunity.

Within South Tyneside Council the PFRA will be taken to cabinet for approval. Due to the timescales involved it may not be possible to submit the cabinet approved PFRA to the



Environment Agency by the 22nd June 2011 deadline. In order for South Tyneside Council to meet the imposed deadline it is proposed to submit the final document, to be tabled at a cabinet meeting on 10th August 2011, and provide the cabinet approved PFRA, including any amendments, to the Environment Agency by the 16th August 2011.

Environment Agency Review

Under the Flood Risk Regulations, the Environment Agency has been given a role in reviewing, collating and publishing all of the PFRAs, once submitted. This review will aim to ensure the national method for identifying flood risk areas has been applied appropriately and consistently by LLFAs across England and Wales. If satisfied with the submission, the Environment Agency will recommend submission to the Regional Flood Defence Committee (RFDC) for endorsement. RFDCs will make effective use of their local expertise and ensure consistency at a regional scale. Once the RFDC has endorsed the PFRA, the relevant Environment Agency Regional Director will sign it off, before all PFRAs are collated, published and submitted to the European Commission.



References

DEFRA (2010) Selecting and Reviewing Flood Risk Areas for Local Sources of Flooding. Guidance to LLFAs. [Online] Accessed January 2011.

<http://www.defra.gov.uk/environment/flooding/documents/research/flood-risk-method.pdf>

DEFRA (2010) Surface Water Management Plan Technical Guidance. [Online] Accessed January 2011.

<http://www.defra.gov.uk/environment/flooding/documents/manage/surfacewater/swmp-guidance.pdf>

Environment Agency (2010). Preliminary Flood Risk Assessment (PFRA). Final Guidance. (Report – GEHO1210BTGH-E-E) [Online] Accessed January 2011.

<http://publications.environment-agency.gov.uk>

Environment Agency (2010). Preliminary Flood Risk Assessment (PFRA). Annexes to the Final Guidance. (Report – GEHO1210BTHF-E-E) [Online] Accessed January 2011.

<http://publications.environment-agency.gov.uk>

South Tyneside Council (2011). Strategic Flood Risk Assessment, Level 1 and Level 2. South Tyneside Council. JBA Consulting. February 2011.

The Pitt Review (2008) Learning Lessons from the 2007 Floods.



Annex 1: Records of past floods and their significant consequences (Preliminary Assessment Spreadsheet)

Please refer to Annex 1 of the Preliminary Assessment Spreadsheet attached with this report. As identified in section x.x, due to the lack of data that was available regarding the consequences of past flooding, no flood events have been considered to have 'significant harmful consequences', therefore none have been recorded in this section.

Annex 2: Records of future floods and their significant consequences (Preliminary Assessment Spreadsheet)

Please refer to Annex 3 of the Preliminary Assessment Spreadsheet attached with this report. This spreadsheet includes a complete record of future flood risk within South Tyneside, including details of potential consequences of flooding to key risk receptors.

Annex 3: Records of Flood Risk Area and its rationale (Preliminary Assessment Spreadsheet)

Please refer to Annex 3 of the Preliminary Assessment Spreadsheet Attached with this report. As identified in section x.x,

Annex 4: Review Checklist

Please refer to Annex 4, attached to this report, which contains a Review Checklist provided by the Environment Agency to be included with the completed PFRA.



Annex 5: Key Flood Risk Photos

The following photos are representative of surface water flooding across South Tyneside.

