# Preliminary Flood Risk Assessment Report
# Solihull Metropolitan Borough Council

May 2011

QM

| Issue/revision | Issue 1 | Revision 1 | Revision 2 | Revision 3 |
|---|---|---|---|---|
| Remarks | Issued as draft for comment | Issued as final draft for client comments | Issued for Solihull MBC Signoff | |
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| Project number | 10260095 | 10260095 | 10260095 | |
| File reference | | | 10260095_PFRA_R2 | |

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This PFRA has been reviewed and authorised by Solihull Metropolitan Borough Council

By

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Date 17th June 2011.

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# Abbreviations

| Acronym | Definition |
|---|---|
| AStGWF | Areas Susceptible to Ground Water Flooding |
| AStSWF | Areas Susceptible to Surface Water Flooding |
| COW | Critical Ordinary Watercourse |
| CSO | Combined Sewer Overflow |
| DEFRA | Department for Environment, Food and Rural Affairs |
| DTM | Digital Terrain Model |
| EA | Environment Agency |
| EU | European Union |
| FMfSW | Flood Map for Surface Water |
| GHG | Greenhouse Gas |
| GIS | Geographic Information System |
| LFRMP | Local Flood Risk Management Plan |
| LiDAR | Light Detection And Ranging |
| LLFA | Lead local Flood Authority |
| NEC | National Exhibition Centre |
| PFRA | Preliminary Flood Risk Assessment |
| PPS25 | Planning Policy Statement 25 |
| RFCC | Regional Flood Coastal Committee |
| SFRA | Strategic Flood Risk Assessment |
| SMBC | Solihull Metropolitan Borough Council |
| STW | Severn Trent Water Ltd. |
| TAN15 | Technical Advice Note 15 |
| WSP | WSP Ltd. |

# Executive Summary

This report has been prepared to enable Solihull Metropolitan Borough Council to fulfil their responsibilities as Lead Local Flood Authority (LLFA) under the flood risk regulations. The Preliminary Flood Risk Assessment (PFRA), comprising this document and the accompanying GIS layer, fulfil the first stage of the requirements under the flood risk regulations.

Solihull Metropolitan Borough has a combination of highly urbanised areas towards the west of the borough, and more rural areas towards the east. It is located within the West Midlands, and covers approximately 180 km2.

Solihull suffered significant flooding in July 2007, particular effects were seen around Nethercote Gardens and Cheswick Green. The consequences of these floods exceed the significance criteria and have therefore been recorded as past flood with potential for significant consequences.

Additional flooding of the area around the Airport, National Exhibition Centre (NEC) and the A45 has also been highlighted as flooding with possible significant consequence due to the national importance of the infrastructure.

This assessment is based upon information provided by the Environment Agency(EA) The EA produce flood maps which are validated and updated as required.

The future flood risk within Solihull has been identified as significant in some parts, the western urbanised areas of the borough are considered to be more at risk of floods due to their built up nature with predicted flooding extents shown on the predicted surface and groundwater maps show potential floods throughout Solihull.

The locally agreed surface water information is based upon the EA's Flood Map for Surface Water (FMfSW) for a 1 in 200 year predicted storm.

The Environment Agency Indicative flood risk area encompasses the western part of Solihull. This map is based upon the FMfSW which is considered to be suitable for the identification of areas at risk of flooding. The outcome of the PFRA suggests that this is accurate; however it is proposed to extend the boundary of the Indicative Flood Risk Area to include the airport, NEC and A45.

The framework for the plan has been agreed with the Environment Agency, the known risks detailed are validated from past flooding, however the future risk, identified from the Environment Agency's flood maps where flooding has not been known before will require further analysis to determine the actual level of significance as defined by a local flood risk strategy.

# 1 Introduction

## 1.1 SCOPE OF THE REPORT

The Preliminary Flood Risk Assessment (PFRA) has been prepared on behalf of Solihull Metropolitan Borough Council (SMBC) by WSP Ltd (WSP) to identify areas within the borough that are at risk of flooding from sources that are not managed by the Environment Agency (EA).

PFRA's are one of the requirements of the European Directive (2007/60/EC), this covers the assessment and management of flood risks and was implemented on 23 October 2007; it is commonly referred to as the 'Floods Directive'. The Floods Directive requires PFRA's to be completed across the European Community, to provide a preliminary assessment of the potential impacts of flooding on human health and life, the environment, cultural heritage and economic activity, with a legislative completion date of December 2011. The EA require PFRA reports to be submitted by 22 June 2011 to ensure all PFRA's are undertaken with a consistent approach. They will then be submitted to the European Commission by 22 December 2011.

## 1.2 AIMS AND OBJECTIVES

The primary output of the PFRA is to identify flood risk areas and provide guidance to be used to support the development of local flood risk management strategies.

In line with the Flood Risk Regulations this report is a high level assessment of the risk of flooding from; surface water, ground water, ordinary water courses and canals and is designed to inform the LLFA, the EA and the European Commission of the potential flood risk within the borough. It is not within the scope of the PFRA to consider, main rivers and reservoirs unless the LLFA believes it to affect flooding from another source. Main Rivers and reservoirs are the responsibility of the EA and will be considered separately.

This report highlights those floods which have significant harmful consequences; a definition of significant harmful consequences is included in Section 3.3.

The PFRA will outline areas within the borough which are at risk of flooding, in line with the national guidance, and are recommended for further consideration of risk reduction measures.

## 1.3 INTRODUCTION TO SOLIHULL

Solihull Metropolitan Borough covers approximately 180 $km^2$. It is situated between Birmingham and Coventry and contains a mixture of residential areas, a busy town centre, business parks and open space. There is a large housing pressure within Solihull due to the proximity, and public transportation links to Birmingham including the main line services to London.

The borough is within an upland catchment of the Rivers Trent and Severn (via the River Avon). The key watercourses within Solihull are:

- River Blythe
- Ravenshaw Brook
- Shadow Brook

- Hollywell Brook
- Low Brook
- River Cole
- Hatchford Brook
- Westley Brook
- Purnells Brook
- Cuttle Brook

The western extents of the borough are heavily developed, the development density decreases towards the east of the borough. The M42 motorway descends north to south through the centre of Solihull, with Birmingham Airport located in the north and the rail lines running east west and west south across the borough. These features are shown in Figure 1.

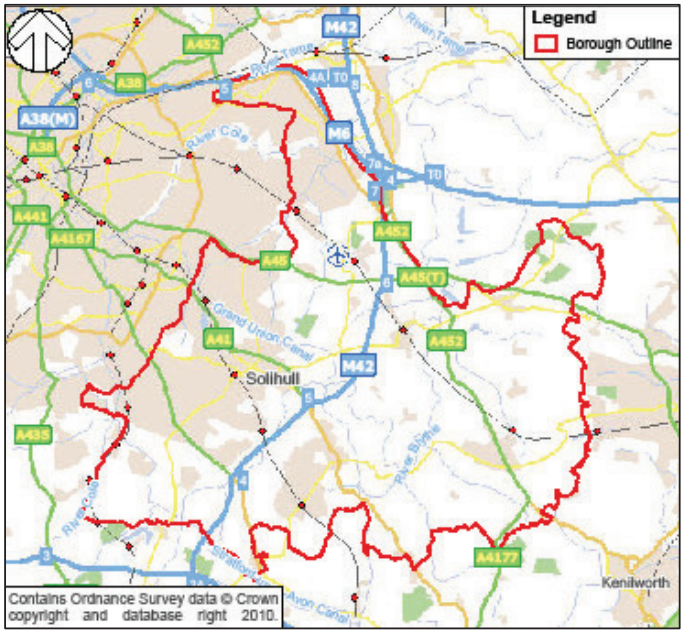



Figure 1: Solihull Metropolitan Borough Outline Map

# 2 Lead Local Flood Authority Responsibility

As a LLFA SMBC hold responsibilities under the Flood Risk Regulation and Flood and Water Management Act. Their primary responsibility is to lead and coordinate flood risk management within their area.

This coordination requires partnership and collaborative working, with bodies holding flood records or maintaining ownership of possible flood risk sources. The success of flood risk management is therefore dependant on effective partnership and stakeholder agreements. Diagram 1 outlines the partnership agreements for Solihull.

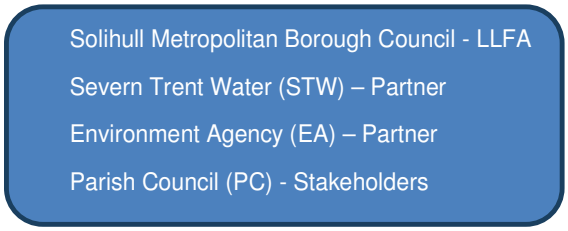



Diagram 1: Solihull partnership agreements

A two tier approach is adopted by SMBC, to reduce flood risk and mitigate the impact of flooding within the borough through two forums:

1. Local Flood Risk Management Partnership
2. Local Flood Management Implementation Board.

The Local Flood Risk Management Partnership meets every 4-6 months and consists of SMBC, the EA and STW. They will ensure that a consistent approach to flood risk management is adopted through operational strategic policy, agreeing investment priorities and funding sources.

Whilst the Local Flood Management Implementation Board meets every 3 months and includes members of staff from SMBC, EA, STW and the emergency services. The roles of the board include ensuring a joined up approach to all flood and water management activities undertaken by SMBC including planning, development control, emergency planning, drainage and asset management.

On-going consulting with the other West Midlands local authorities is undertaken to ensure that best practise has been adopted across the region.

# 3 Methodology and Data Review

## 3.1 DATA AVAILABILITY AND REVIEW

The partner and stakeholder organisations, as outlined in Section 2, have been contacted to provide data. Diagram 2 outlines the data which was received from each organisation.

The following section discusses the available data and provides a review with respect to quality. Table 1 outlines the methodology behind the quality score for the data. Table 2 outlines the data and its quality review.

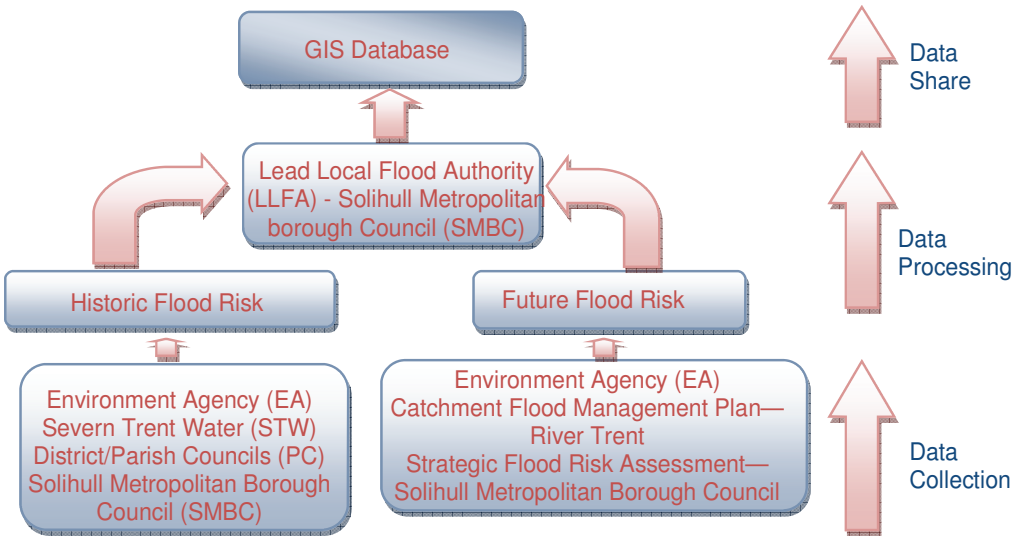



Diagram 2: Data collection, processing and dissemination

Table 1 Data Quality Methodology – as shown in the Defra publication "Selecting and reviewing Flood Risk Areas for Local Sources of Flooding"

| Data Quality Score | Description | Explanations | Example |
|---|---|---|---|
| 1 | Best possible | No better available; not possible to improve upon in the near future | High resolution LiDAR<br>River/sewer flow data<br>Rain gauge data |
| 2 | Data with known deficiencies | Best replaced as soon as new data available | Typical sewer or river model that is a few years old |
| 3 | Gross assumptions | Not invented but based on experience and judgement | Location, extent and depth of much surface water flooding<br>Operation of un-modelled highway drainage<br>'future risk' inputs e.g. rainfall population |
| 4 | Heroic assumptions | An educated guess | Ground roughness for 2d model |

Table 2 Data Quality Review

| Data Type | Data | Description | Quality |
|---|---|---|---|
| Historic Data | SMBC Data | All historic flooding records only include known floods. These records rely on information provided by the general public, and by resulting damage from floods. They are therefore reliant on qualitative information and therefore may not be definitively inclusive. There are differing collection and registering methods utilised across the differing organisations and areas. | 3/4 |
| | EA Flood Records | | |
| | Parish Council Records | | |
| | STW Records | | |
| | BW Records | | |
| Predicted Future Floods | Areas Susceptible to Surface Water (AStSW) | AStSW flooding maps exclude underground drainage systems and buildings. The model is built using this simplified digital terrain model and applying a 1 in 200 annual probability storm over a duration of 6.5 hours to the whole of the UK. This event was chosen as it was believed to produce flooding in the most significant of pathways and storage areas. This model is based on general assumptions and is applied at a resolution of 5m. This means that this is an indicative map which highlights areas which may be prone to surface water flooding. It cannot be used as a definitive way of selecting areas at risk of surface water | 3 |

| | | | |
|---|---|---|---|
| | | flooding. | |
| | Flood Map for Surface Water (FMfSW) | The FMfSW are the second generation maps produced following the areas susceptible to surface water flooding maps. These were produced to take into account underground drainage systems and building topography. The FMfSW provides outputs showing deep (>0.3) and shallow (>0.1m) flooding for a 1 in 30 year and a 1 in 200 year rainfall event, full details of the methodology applied to the model can be viewed in the Environment Agency publication "What is the flood map for surface water: Guidance for LRF, RRT, LPA and LLFA V1 November 2010". The Flood map for surface water gives an indication of flow paths and areas likely to flood. It only accounts for local rainfall and does not provide an indication of flooding from catchment wide rainfall and overflowing of sewer and water courses. It can only be used as a guide to areas which may flood; it cannot be used to determine the flooding potential of individual properties as the model uses national coefficients and lower resolution digital terrain models. | 2 |
| | Areas Susceptible to Ground Water (AStGW) | The AStGW flooding is divided into 1 km squares which illustrate the percentage of the square which is susceptible to groundwater flooding. However, it does not show the likely locations of groundwater flooding. The modelling used accounts for consolidated aquifers and consolidated deposits, it does not account for the probability of flooding from groundwater rebound. | 3 |
| | Flood Map | The EA Flood Map, showing the locations of flood zones 2 and 3 has been provided. It gives an indication of areas which may flood but cannot be used to ascertain flooding at individual property level. | 2 |
| Geographic Information | Terrain DTM Model | DTM has been utilised at a 1 m resolution, this is a high resolution digital terrain model. Though this is not the highest resolution available and there can be inconsistencies, particularly around wooded areas, it is a good representation and is unlikely to be the limiting factor when utilised with surface water models and similar. | 2 |
| | Existing Infrastructure | This information is the best available, highlighting the location of water management infrastructure, including sewerage systems, and flood defences. | 2 |

| | | | |
|---|---|---|---|
| | | Though this information is not exact, it is unlikely to be inaccurate enough to increase error significantly in models and assessments. | |
| | Local area NRD | National Receptor Database: information on population and land use is provided. This information is the best available but may not be up to date. The effects of this are minimal for the purposes of a PFRA. | 2/3 |
| Flood Risk Documentation | Solihull Strategic Flood Risk Assessment | The strategic flood risk assessment for Solihull has been reviewed. | 2 |
| | Catchment Flood Management Plan | The Catchment Management Plans for the River Trent have been reviewed. | 2 |

## 3.2 INFORMATION STORAGE AND SHARING

All information will be maintained by SMBC within a GIS database. This information will be available to 3rd parties at the discretion of the LLFA.

All information is issued subject to a licensing agreement which will be received with the data.

## 3.3 SIGNIFICANCE OF FLOOD RISK

The national flood risk areas are outlined in the DEFRA guidance "Selecting and Reviewing Flood Risk Areas for Local Sources of Flooding". These are outlined in table 3.3.1. Any floods with effects that exceed the indicators listed below are considered to have significant consequences.

| Consequence | National Indicator for England | Additional factors listed | Proposed Definition for Solihull borough |
|---|---|---|---|
| Human Health | 30,000 people, 150 critical services | | Internal flooding to 5 or more residential properties (11.7 people assuming 2.34 people per property) |
| Economic Activity | 3,000 non residential properties, | Agricultural land, Roads and Rail | Flooding to 2 or more business premises |
| Environment | | Nationally or internationally designated sites, nationally or internationally recognised heritage site | Flooding to 1 or more items of critical infrastructure, or a transport link impassable for in excess of 10 hours. |

Table 3: Definition of significant flood risk as derived for Solihull

# 4 Past Flood Risk

Historic flood data has been received from all stakeholders as outlined in Diagram 2. This data has been reviewed, imported into GIS to allow spatial comparison of the data, and has been assessed to identify any historic floods with significant consequences. All known historic floods are included within the Historic Flooding Map included as Appendix A. Those floods with significant consequences are incorporated into the Preliminary Flood Risk Assessment spread sheet. Table 4 illustrates the different types of flood.

| Flood Type | Flood Description |
|---|---|
| Fluvial | Fluvial flooding is flooding attributed to water courses, such as rivers, streams, lakes or brooks.<br><br>**NB:** It is not within the scope of the PFRA to consider the flood risk from sea, main rivers and reservoirs unless the LLFA believes it to affect flooding from another source.<br><br>It is important to highlight the differences between Main Rivers, Ordinary Watercourses, and Critical Ordinary Watercourses (COWs). Main Rivers are are generally the larger arterial watercourses and have been designated by the EA/Defra, the EA holds responsibility for flood risk management of these watercourses. The EA have now assimilated the Critical Ordinary Watercourses (COWs) into the Main River network, these were previously the responsibility of the local authorities. Local Authorities are responsible for flood risk management of the Ordinary Watercourses, these are generally the smaller undesignated watercourses with a lower potential of flood risk.<br><br>Therefore within the PFRA only ordinary watercourses are considered. |
| Artificial Sources | Artificial sources include all man made water bodies, this can include reservoirs, canals, artificial lakes. As discussed above the EA holds responsibility for flood risk associated with main reservoirs, therefore these are not to be considered as part of the PFRA unless the LLFA believe it contributes to other sources of flooding. |
| Surface Water | Surface water flooding includes flooding caused by rainfall which does permeate into the ground and remains on the surface. This may include standing ponds or overland flow of water. It also includes flooding from the built surface water sewerage system. |
| Groundwater | Groundwater flooding includes flooding from groundwater sources. |

Table 4: Flooding type description

## 4.1 SUMMARY OF HISTORIC FLOOD RISK

***Fluvial***

Historic records of fluvial flooding are concentrated on the River Blythe and the River Cole. During the 2007 extreme rainfall event, with frequency of 1 in 75 years, there was extensive flooding of both the Rive Blythe and River Cole. Though the River Blythe is a main watercourse and is therefore not within the scope of this PFRA, the flooding of the River Blythe was also connected to localised flooding from ordinary water courses (in addition to the River Cole) which was present in areas throughout the borough. This resulted in the internal flooding in excess of 20 properties, concentrated around Nethercote Gardens and Cheswick Green.

There are also historic records of Low Brook flooding, the extents of which include A45 and the boundary fence of Birmingham Airport. This is again a Main River and therefore not included within the scope of this report, however, this brook is linked to associated ordinary watercourses.

There are no other fluvial flooding records with known significant harmful consequences.

***Surface Water***

There are multiple records of surface water flooding within the Solihull area. These are spread throughout the Borough, but are concentrated towards the west. These are attributed to overland flows, inundation of the sewerage system and overtopping of drainage ditches. There are no records of surface water flooding with significant harmful consequences.

Surface water flooding is thought to have a notable contribution to the significant fluvial events outlined above.

There are multiple critical drainage areas within Solihull, these are again concentrated within the west. The Local Flood Risk Management Plan for the River Cole suggests that Combined Sewer Outfall's (CSO's) contribute heavily to the flows within the water courses in Solihull.

***Groundwater flooding***

There are no confirmed records of groundwater flooding within the borough. However, there has been a recent increase of unsubstantiated reports of groundwater emergence beneath the floors of properties, particularly within the Shirely area. These suggest that there has been a recent increase in the occurrence of groundwater flooding within Solihull.

***Flooding from artificial sources***

There are a number of canals and impounded water bodies within the Solihull area. There is only one record of flooding from an artificial course, namely a breach of the Grand Union Canal near Copt Heath. This was attributed to a farmer excavating the toe or the embankment causing a slope failure.

There are no known consequences of this breach and so are assumed to not be significantly harmful.

## 4.2 SUMMARY OF HISTORIC FLOODING CONSEQUENCES

There are three events which are considered to have significant consequences, namely the flooding of Rivers Cole and Blythe and Low Brook. The Rivers Blythe and Low Brook are main rivers and therefore not a consideration as part of the PFRA, however, they have a significant effect on adjoining ordinary watercourses, and the built drainage system which is believed to be reliant on CSO's. They are therefore reported within the Appendix A. The River Cole is not a main river within the area of Nethercote Gardens and is therefore reported within Appendix A.

# 5 Future Flood Risk

This section summarises the future flood risk within the borough. Future flood risk with significant harmful consequences is also listed within Appendix B, within the preliminary assessment report spread sheet. All maps showing the predicted floods discussed in sections 5.1 to 5.4 are included within Appendix B.

The assignment of risk level, low, medium or high is based upon a combination of the level of risk and the coverage of risk, so for example, an area which is a low flood risk, but the risk extends throughout the borough will be classified as medium risk. This is illustrated in Table 5.

| | Coverage | | |
|---|---|---|---|
| **Risk Level** | **High** | **Medium** | **Low** |
| **High** | High | High | Medium |
| **Medium** | High | Medium | Low |
| **Low** | Medium | Low | Low |

Table 5: Outline of risk assignment methodology

## 5.1 LOCALLY AGREED SURFACE WATER INFORMATION

The locally agreed surface water information is predominantly based upon the FMfSW 1 in 200 year predicted event. However, due to the known connections between surface water and the sewerage system, the FMfSW 1 in 30 year predicted event should also be used for reference. There is believed to be a close link between fluvial and surface water flood events within Solihull. Consequently the report: the River Cole Local Flood Risk Management Plan (LFRMP), Atkins 2010, can be used for additional reference.

## 5.2 PREDICTED FUTURE FLOOD RISK

### 5.2.1 Fluvial Flooding

The Environment Agency has provided the Flood Map for Solihull, there are a significant number of ordinary watercourses within the borough however, the majority of these will not be included within the EA flood map. It should also be noted that the SFRA suggests that the Flood map appears to be misaligned in places and should therefore be used with caution.

There are records of significant historical fluvial floods within Solihull, these are mostly attributable to main rivers. However, raised water levels and flooding in the main rivers are considered likely to be linked to raised levels and flooding of associated ordinary watercourse. The Flood Map shows areas of development and residential properties within Flood Zones 2 and 3, but these are again attributed to main rivers. From our understanding of the available information, including the flood map it is likely that if the ordinary watercourse were modelled they would show flood risk areas.

As outlined in the report: the River Cole Local Flood Risk Management Plan (LFRMP), Atkins 2010; CSO's make a significant contribution to the volume of water, and the quality of water, within the watercourses. This will therefore have an impact on flooding from fluvial sources. This also links flooding from fluvial sources with flooding from surface water, meaning that flooding within the areas surrounding watercourses is likely to be a combination of both.

Consequently the risk from fluvial flooding is considered to be as follows;

- Areas within close proximity and low lying areas surrounding main watercourses, or ordinary watercourses with CSO's: **high risk** (as outlined within the EA flood map). These floods have the potential to have significant harmful consequences.
- Areas within close proximity and low lying areas surrounding ordinary watercourses: **medium risk.** These floods have the potential to have significant harmful consequences.
- Other areas: **low risk.** The risk of floods in these locations resulting in significant harmful consequences is thought to be low.

Additional work would need to be undertaken for specific areas to ascertain the fluvial flood risk for specific locations.

### 5.2.2 Surface Water Flooding

The SFRA for Solihull suggests that there are a number of Critical drainage locations within the borough. As outlined within Section 5.1.1, the LFRMP for the River Cole discusses the contribution of CSO's to the water volumes within the watercourses and the resulting close link between surface water flooding and fluvial flooding.

The Flood Map for Surface Water suggests that small areas of localised ponding would be a risk throughout urban areas of the borough in both the 1 in 30 year and 1 in 200 year events. The urban areas, and consequently surface water flooding is concentrated along the western side of the borough.

In urban areas, surface water is reliant on the built sewerage system to drain. In the event of high river levels, this is likely to result surface water and combined sewers backing up and may result in flooding from the built sewers.

The risk of surface water flooding in the area is as follows;

- Urban areas; **medium risk,** however this may be increase for areas close to CSO's and there is the potential for significant harmful consequences, in particular in close proximity to CSO's.
- Rural and permeable areas; **Low risk,** it is not believed that the consequences are likely to be significant.

The consequences of predicted future floods have been provided by the EA and have been undertaken using a detailed GIS count. Table 6 outlines the predicted potential effects of a surface water flood as represented by the FMfSW.

| | | FMfSW 1 in 200 >0.3 |
|---|---|---|
| **Human Health** | No. of People | 7341 |
| | No. of Critical Services | 20 |
| **Economic Activity** | No. of non-residential properties | 385 |

Table 6: Potential consequences of surface water flood

### 5.2.3 Groundwater Flooding

There are no substantiated historical problems associated with ground water, however Areas Susceptible to Ground Water Flooding Map (AStGWF) suggests large areas of the borough are potentially at risk. Although the Shirley area, where there has been historical unsubstantiated records of flooding, falls within the 25-75% risk area, mainly in the areas of lower risk. The AStGWF shows the areas at highest risk of groundwater flooding are along the western side of the borough, within the highly urbanised areas and concentrated around water courses.

The highly urbanised nature of the borough and the associated impermeable ground surface will reduce the available areas in which ground water can surface. Throughout the entire borough there are many watercourses which will channel and drain ground water.

It is therefore less likely that ground water will cause flooding problems within urban areas; unsubstantiated reports suggest that groundwater flooding is increasing within the borough, however any groundwater problems are more likely to be located close to watercourses and therefore likely to be within the fluvial flood plain, or associated with additional sources of flooding.

The available information indicates that groundwater can be considered to be **Low risk,** although some localised areas may be at medium risk, throughout the borough and the potential consequences are not considered likely to be significant.

### 5.2.4 Flooding from Artificial Sources

There are no historic records of flooding from artificial sources which were not caused by third party actions. Historic records of canal flooding were due to excavations at the canal toe. Flooding from artificial sources, including reservoirs and canals is unusual, and the extents are usually limited. In Solihull consequences from flooding from artificial sources has the potential to be large if the event were within an urban area, however, artificial water bodies are mostly located in the lesser developed west of the borough.

Flooding from artificial sources is therefore considered to be **Low risk.** The potential consequences are not considered to be likely to have significant harmfully effects.

## 5.3 THE IMPACTS OF CLIMATE CHANGE

**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 around 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%.

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

- Winter precipitation increases of around 12% (very likely to be between 2 and 26%) Precipitation on the wettest day in winter up by around 12% (very unlikely to be more than 24%)
- Relative sea level at Grimsby very likely to be up between 10 and 41cm 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 14%

**Implications for Flood Risk**
Climate changes 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. 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 drier summers, so we need to be prepared for the unexpected.

Drainage systems in the district have been modified to manage water levels and could help in adapting locally to some impacts of future climate on flooding, but may also need to be managed differently. Rising sea or river levels may also increase local flood risk inland or away from major rivers because of interactions with drains, sewers and smaller watercourses. Even small rises in sea level could add to very high tides so as to affect places a long way inland.

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.

Although the broad climate change picture is clear, we have to make local decisions uncertainty. 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

## 5.4 LONG TERM DEVELOPMENT

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."

In Wales, Technical Advice Note 15 (TAN15) on development and flood risk sets out a precautionary framework to guide planning decisions. The overarching aim of the precautionary framework is "to direct new development away from those areas which are at high risk of flooding."

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).

# 6 Review of Indicative Flood Risk Areas

The EA has provided a plan showing areas of Indicative Flood Risk based upon the national indicators as outlined in Section 3.3. This map has been developed based upon clustering 1 km grid squares where at least 200 people, 20 business or 1 critical service have the potential to be flooded to a depth of over 0.3 m. This is based upon the Flood Map for Surface Water predicted flood extents with approximately 1 % probability of occurring in any given year. This method is outlined further in the DEFRA guidance "Selecting and Reviewing Flood Risk Areas for Local Sources of Flooding".

The "Indicative Flood Risk Area Map" can be seen in Appendix C. As shown on the map the majority of the western more urbanised area of Solihull is included within the indicative flood risk area.

The indicative flood risk area is based upon the FMfSW for the 1 in 30 year event. This is considered to be the most suitable source of information to use as a basis for the flood risk areas for Solihull borough as it is the most known. There are known flooding problems associated with fluvial sources within the borough, however, additional assessment would be necessary to accurately assess the risks posed and the predicted consequences. Additional work is being undertaken, including the LFRMP, to provide additional assessment of these risks.

Consideration of the Indicative Flood Risk Areas with respect to the data gathered and conclusions drawn as a part of this PFRA confirms that the locations given should remain within the indicative flood risk area. This shows the predominant areas of the borough where significant consequences could occur which are the developed areas.

However, an alteration to the Indicative Flood Risk Area is proposed. It is proposed to extend the outline to include the Airport, the NEC and the A45 (until its junction with the M42). These are seen as essential national infrastructure located in an area of known historical flooding, as discussed in Section 4.1. The flooding within this area is known to have significant consequences on national economic activity and is therefore considered to be suitable for inclusion within the Indicative Flood Risk Area. The plan attached in Appendix C shows the extent of the Indicative Flood Risk Area proposed by the EA and also outlines the proposed extension.

# 7 Indicative Flood Risk Areas

As discussed in Section 6, there is an addition proposed to the flood risk areas presented by the EA, to include the Airport, the NEC and the A45. The flood risk area therefore includes the western area of Solihull bordering Birmingham, extending to include the M42 and A45 in the north east of the borough.

The indicative flood risk areas can be seen on the map provided in Appendix E. This plan shows two outlines, one for the existing Flood Risk Area identified by the EA, and a second showing the additional proposed area. The combination of both outlines constitutes the total area to be taken forward as an Indicative Flood Risk Area.

# 8 Next Steps

As outlined above, the PFRA is the first element of identifying areas that could be at a nationally significant risk of flooding. Further work will be required in future years to confirm the risk and hazard prior to producing flood management plans. These plans will communicate the nature of the flood risk, and the measures proposed to manage these risks.

The PFRA is a document required by UK legislation to comply with the European Floods Directive and should be considered to be a high level document for the Council to provide the foundation and guide for future work to inform the LLFA of the risks. The future work will build upon the PFRA to produce flood extents and hazard mapping as well as a Local Flood Risk Strategy which could consist of guidance notes, particularly for blue light services through to evacuation plans and protection/mitigatory measures.

Additional assessment, in particular the River Cole and localised hotspots is being undertaken as additional work.

A continuing maintenance of a flood database will also be undertaken as part of SMBC's Role as an LLFA.

The review process is set out by the EC requirements; this PFRA has been audited internally by the Council prior to submission to the EA for review by 22 June 2011.

The Environment Agency will undertake a technical review (area review and national review) of the PFRA, which will focus on ensuring that the format of this document meets the required criteria. If satisfied, they will recommend submission to the relevant Regional Flood Coastal Committee (RFCC) for endorsement. RFCCs will make effective use of their local expertise and ensure consistency at a regional scale. Once the RFCC has endorsed the PFRA, the relevant Environment Agency Regional Director will sign it off, before all PFRAs are collated, and published. The first review cycle of the PFRA will be led by Solihull and must be submitted to the Environment agency in 2017

In order to continue to fulfil their role as Local Lead Flood Authority, Solihull Council are required to investigate future significant flood events and ensure continued collection, assessment and storage of flood risk data and information. However it is crucial that all records of flood events are documented consistently and in accordance with the INSPIRE Directive (2007/2/EC). The INSPIRE directive aims to create an EU spatial data infrastructure. This will enable the sharing of environmental spatial information among public sector organisations and better facilitate public access to spatial information across Europe. It is recommended that a centralised database will be kept up to date by Solihull Council, who has the overall responsibility to manage flood data through the whole administrative area of Solihull. This can be used as an evidence base to inform future assessments and reviews and for input into the mapping and planning stages.

# 9 References

Atkins 2010, The River Cole Local Flood Risk Management Plan (LFRMP)

Defra, 2009, Selecting and reviewing Flood Risk Areas for local sources of flooding: Guidance to Lead Local Flood Authorities

Environment Agency, July 2010, Preliminary Flood Risk Assessment (PFRA) Final Guidance

Environment Agency; January 2010; River Trent Catchment Flood Management Plan, summary report

Halcrow, January 2008, Solihull Metropolitan Borough Council Strategic Flood Risk Assessment for local development framework, level 1, volume 1 – Final.

# Appendices, Figures & Tables

# Appendix A Record of Past Floods and their Significant Consequences

**PRELIMINARY FLOOD RISK ASSESSMENT SPREAD SHEET**

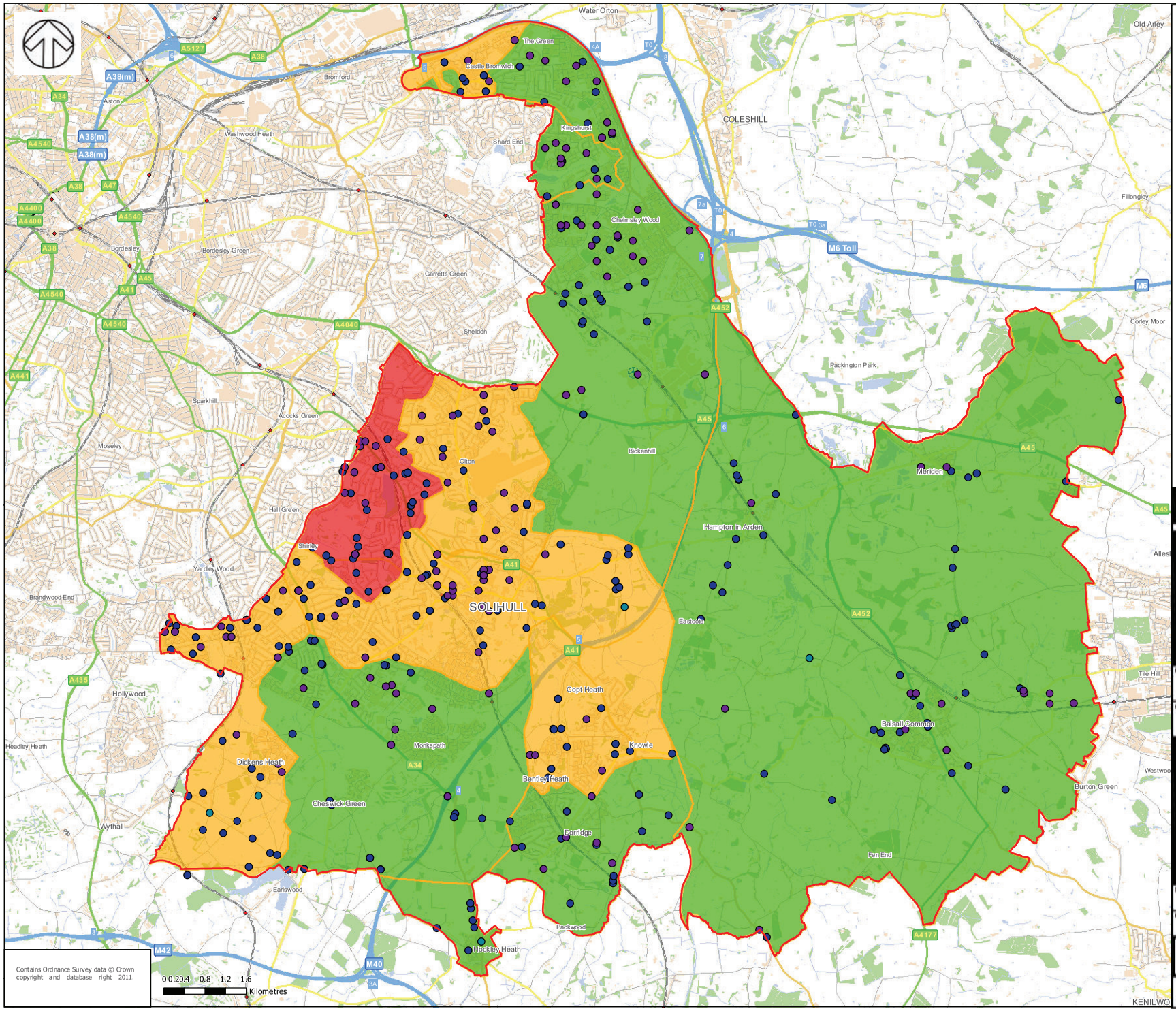
**PLAN SHOWING ALL HISTORIC FLOODS**

**ANNEX 1: Records of past floods and their significant consequences** (preliminary assessment report spreadsheet)

| Field: | Flood ID | Summary description | Name of Location | National Grid Reference | Location Description | Start date | Days duration | Probability | Main source of flooding | Additional source(s) of flooding | Confidence in main source of flooding |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mandatory / optional: | **Mandatory** | **Mandatory** | **Mandatory** | **Mandatory** | Optional | Optional for first cycle | Optional for first cycle | Optional for first cycle | Optional for first cycle | Optional | Optional |
| Format: | Unique number between 1-9999 | Max 5,000 characters | Max 250 characters | 12 characters: 2 letters, 10 numbers | Max 250 characters | 'yyyy' or 'yyyy-mm' or 'yyyy-mm-dd' | Number with two decimal places | Max 25 characters | Pick from drop-down | Max 250 characters, same source terms | Pick from drop-down |
| Notes: | A sequential number starting at 1 and incrementing by 1 for each record. | Description of the flood and its adverse or potentially adverse consequences. Where available, information from other fields (Start date, Days duration, Probability, Main source, Main mechanism, Main characteristics, Significant consequences) should be repeated here. | Name of the locality associated with the flood, using recognised postal address names such as streets, towns, counties. If the flood affected the whole LLFA, then record the name of the LLFA. | National Grid Reference of the centroid (centre point, falls within polygon) of the flood extent, or of the area affected if there is no extent information. | A description of the general location that was flooded. | The date when the flood commenced - when land not normally covered by water became covered by water. | The number of days (duration) of the flood - that land not normally covered by water was covered by water. Values should be within the range 0.01 - 999.99 (permitting records to the nearest quarter of an hour, where appropriate). | The chance of the flood occuring in any given year - record X from "a 1 in X chance of occurring in any given year". Where this is difficult to estimate, a range can be recorded. | Pick the source from which the majority of flooding occurred. Refer to the PFRA guidance for definitions of sources. | If flooding occurred from, or interacted with, any other sources (other than the Main source of flooding), report the source(s) here, using the same source terms. | Pick a broad level of confidence in the Main source of flooding from; 'High' (compelling evidence of source - about 80% confident that source is correct), 'Medium' (some evidence of source but not compelling - about 50% confident that source is correct) 'Low' (source assumed - about 20% confident that source is correct) or 'Unknown'. |
| Example: | 1 | On the 14 April 1998 an intense storm system produced surface water flooding across Essex, concentrated in the west of the county. The flooding lasted about 6 hours, and 23 residential properties were recorded as suffering internal flooding, in Epping and North Weald. The surface runoff exceeded the drainage capacity in several places, and so probably had a 1 in 30 to 1 in 50 chance of occuring in any given year. | Essex | SX1234512345 | Several towns and villages across west Essex | 1998-04-15 | 0.25 | 20-50 | Surface runoff | | High |
| Records begin here: | 1 | On 20th July a period of wet weather was followed by an intense rainfall event causing the River Cole and River Blythe to flood. In the region of 20 properties suffered internal flooding in the Solihull area although many more were threatened with flooding. Many smaller watercourses also caused localised flooding. The period of intense rainfall experienced represented a 1 in 75 year storm event. Propery flooding lasted in escess of 4 hours and river levels did not return to non-flood flow conditions for 48 hours. | Nethercote Gardens, Shirley suffered significant flooding fom the River Cole (Ordinary Watercourse) | SP4103827904 | Residential estate adjacent to River Cole. | 20/07/2007 | 0.5 | 0.33 | Ordinary watercourses | Secondary sources apply. Floodwater overtopped adjacent Mill Pond flowing down to Netercote Gardens. Drainage system was unable to cope or discharge into the river. Road splash | High |
| | 2 | On 20th July a period of wet weather was followed by an intense rainfall event causing the River Cole and River Blythe to flood. In the region of 20 properties suffered internal flooding in the Solihull area although many more were threatened with flooding. Many smaller watercourses also caused localised flooding. The period of intense rainfall experienced represented a 1 in 75 year storm event. Propery flooding lasted in escess of 4 hours and river levels did not return to non-flood flow conditions for 48 hours. | Cheswick Green suffered significant flooding from the River Blythe (Main River) at the confluence of Mount Brook | SP4125227556 | Residential estate adjacent to River Blythe. | 20/07/2007 | 0.5 | 0.33 | Main rivers | River Blythe backs up Mount Brook causing the brook to overtop banks | High |
| | 3 | On several occassions including the summer of 2007 flooding from the Low Brook occurred at the boundary fence of Birmingham Airport. Although the flood water did not extend to the adjacent runway the A45 Coventry Road was been adversley affected. Debris collecting on the airport security fence across the watercourse contributes to the risk of flooding. | Low Brook is Main River at this location. The A45 is a main access route into Birmingham and provides access to Birmingham Airport. | SP4178728298 | Potential disruption to air and road transport infrastructure | 20/07/2007 | 0.3 | 0.5 | Main rivers | Blockage due to debris on security fence can cause flooding of A45 Coventry Road without generalised flooding. | High |

| Main mechanism of flooding | Main characteristic of flooding | **Significant consequences to human health** | Human health consequences - residential properties | Property count method | Other human health consequences | **Significant economic consequences** | Number of non-residential properties flooded | Property count method | Other economic consequences | **Significant consequences to the environment** | Environment consequences | **Significant consequences to cultural heritage** | Cultural heritage consequences |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Optional for first cycle<br>Pick from drop-down<br><br>Pick a mechanism from; 'Natural exceedance' (of capacity), 'Defence exceedance' (floodwater overtopping defences), 'Failure' (of natural or artificial defences or infrastructure, or of pumping), 'Blockage or restriction' (natural or artificial blockage or restriction of a conveyance channel or system), or 'No data'. | Optional for first cycle<br>Pick from drop-down<br><br>Pick a characteristic from; 'Flash flood' (rises and falls quite rapidly with little or no advance warning), 'Natural flood' (due to significant precipitation, at a slower rate than a flash flood), 'Snow melt flood' (due to rapid snow melt), 'Debris flow' (conveying a high degree of debris), or 'No data'. Most UK floods are 'Natural floods'. | **Mandatory**<br>Pick from drop-down<br><br>Were there any significant consequences to human health when the flood occurred, or would there be if it were to re-occur? | Optional<br>Number between 1-10,000,000<br><br>Record the number of residential properties where the building structure was affected either internally or externally by the flood, or that would be so affected if the flood were to re-occur. | Optional<br>Pick from drop-down<br><br>Where residential or non-residential properties have been counted, it is important to record the method of counting, to aid comparisons between counts. Choose from; 'Detailed GIS' (using property outlines, as per Environment Agency guidance), 'Simple GIS' (using property points), 'Estimate from map', or 'Observed number'. | Optional<br>Max 250 characters<br><br>If there were other Significant consequences to human health, describe them including information such as the number of critical services flooded. | **Mandatory**<br>Pick from drop-down<br><br>Were there any significant economic consequences when the flood occurred, or would there be if it were to re-occur? | Optional<br>Number between 1-10,000,000<br><br>Record the number of non-residential properties where the building structure was affected either internally or externally by the flood, or that would be so affected if the flood were to re-occur. | Optional<br>Pick from drop-down<br><br>Where residential or non-residential properties have been counted, it is important to record the method of counting, to aid comparisons between counts. Choose from; 'Detailed GIS' (using property outlines, as per Environment Agency guidance), 'Simple GIS' (using property points), 'Estimate from map', or 'Observed number'. | Optional<br>Max 250 characters<br><br>If there were other Significant economic consequences, describe them including information such as the area of agricultural land flooded, length of roads and rail flooded. | **Mandatory**<br>Pick from drop-down<br><br>Were there any significant consequences to the environment when the flood occurred, or would there be if it were to re-occur? | Optional<br>Max 250 characters<br><br>If there were Significant consequences to the environment, describe them including information such as national and international designated sites flooded, and pollution sources flooded. | **Mandatory**<br>Pick from drop-down<br><br>Were there any significant consequences to cultural heritage when the flood occurred, or would there be if it were to re-occur? | Optional<br>Max 250 characters<br><br>If there were Significant consequences to cultural heritage, describe them including information such as the number and type of heritage assets flooded. |
| Natural exceedance | Natural flood | Yes | 23 | Observed number | | No | | | | No | | No | |
| Natural exceedance | Natural flood | Yes | 37 | Observed number | Risk to health from contaminated flood water | Yes | 0 | Estimate from map | | No | | No | |
| Natural exceedance | Natural flood | Yes | 10 | Observed number | Risk to health from contaminated flood water | Yes | 3 - Village Hall, Shop and Post Office | Estimate from map | | No | | No | |
| Natural exceedance | Natural flood | Yes | 0 | Estimate from map | Risk of injury to travelling public | Yes | Disruption to main 'A' road between Birmingham and Coventry. Disruption to main access route to Birmingham Airport and possible flooding to end of runway.. | Observed number | During worst recent incident in 2007 the A45 closed to traffic for 6hrs. | No | | No | |

| Comments | Data owner | Area flooded | Flood event outline confidence | Flood event outline source | Survey date | Photo ID | Lineage | Sensitive data | Protective marking descriptor | European Flood Event Code |
|---|---|---|---|---|---|---|---|---|---|---|
| Optional<br>Max 1,000 characters<br><br>Any additional comments about the past flood record. | Optional<br>Max 250 characters | Optional<br>Number with two decimal places<br>The total area of the land flooded, in $km^2$ | Optional<br>Pick from drop-down<br><br>Choose from; 'High' (data includes one of: Aerial video, Aerial photos, Professional survey, Flood level information, EA flood data recording staff notes), 'Medium' (data includes one of: EA/LA ground video, EA/LA ground photos, EA/LA flood event outline map, LA/professional partner officer site records, Public ground video), 'Low' (not confident) or | Optional<br>Pick from drop-down | Optional<br>'yyyy' or 'yyyy-mm' or 'yyyy-mm-dd' | Optional<br>Max 50 characters<br><br>Provide references to relevant specific photographs, or to a set of relevant photographs. It may not be practical to reference all relevant photographs for each flood event. | Optional<br>Max 250 characters<br><br>Lineage is how and what the data is made from. Has this data been created by using data owned or derived from data owned by 3rd party (external) organisations? If yes please give details. | Optional<br>Pick from drop-down<br><br>Has the information been classified under the Government's Protective Marking Scheme? Include protective marking time limit where known. Note: If "Approved for Access" then report "Unmarked". | Optional<br>Max 50 characters<br><br>For use where organisations apply the Government's Protective Marking Scheme. | Auto-populated<br>Max 42 characters<br><br>This field will autopopulate using the LLFA name provided on the "Instructions" tab, and the Flood ID. It is an EU-wide unique identifier and will be used to report the flood information.<br><br>Format: UK<ONS Code><P or F><LLFA Flood ID>. "ONS Code" is a unique reference for each LLFA. "P or F" indicates if the event is past or future. "LLFA Flood ID" is a sequential number beginning with 0001. |
| | Epping Forest District Council | | Medium | Site survey | 1998-04-20 | | Ordnance Survey AddressPoint; CEH 1:50k River Centreline; NextMap DTM. | Unmarked | Private | UKE10000012P0001 |
| Flood insurance is becoming difficult for property owners | Solihull Metropolitan Borough Council | 0.03 | Medium | Professional staff notes | 2010 | | River Cole Local Flood Risk Management Plan - Assessment of Flood Risk November 2010. Prepared by Atkins Ltd for Birmingham City Council and Solihull Metropolitan Borough | Unmarked | | UKE09000002P0001 |
| Flood insurance is becoming difficult for property owners | Solihull Metropolitan Borough Council | | Medium | | 2010 | | Cheswick Green Parish Council Fooding Report | Unmarked | | UKE09000002P0002 |
| The proposed runway extension will take the runway across the existing A45 which is scheduled for realignment. | Solihull Metropolitan Borough Council | | Medium | | | | | | | UKE09000002P0003 |




Drawn By:

File:

**DO NOT SCALE**

KEY

- Borough Outline
- Council Records of Historic Floods
- Parish Council Records of Historic Floods
- Fire Service Historic Events
- < 3 Critical Drainage Locations within Catchment
- < 5 Critical Drainage Locations within Catchment
- < 10 Critical Drainage Locations within Catchment

NOTE: CRITICAL DRAINAGE LOCATIONS ARE NOT SHOWN BY INDIVIDUAL LOCATION BUT ARE SHOWN CODED BY THE NUMBER OF LOCATION WITHIN A CATCHEMENT

DRAWING STATUS: FOR INFORMATION

WSP
Mountbatten House, Basing View, Basingstoke, Hampshire RG21 4HJ
Tel: +44 (0)1256 318800 Fax: +44 (0)1256 318700
http://www.wspgroup.com

CLIENT: SOLIHULL METROPOLITAN BOROUGH COUNCIL

ARCHITECT:

PROJECT: SOLIHULL METROPOLITAN BOROUGH COUNCIL
PRELIMINARY FLOOD RISK ASSESSMENT

TITLE: HISTORIC FLOODING DATA

| SCALE @ A1: | CHECKED: | APPROVED: |
|---|---|---|
| 1:50,000 | AS | OH |
| CAD FILE: | DESIGN DRAWN: | DATE: |
| WSP - A2 Landscape | EJO | March 2010 |
| PROJECT No: | DRAWING No: | REV: |
| 10260095 | PFRA - APPENDIX A | A |

# Appendix B Records of Future Floods and their Consequences

**PRELIMINARY ASSESSMENT REPORT SPREADSHEET**

**AREAS SUSCEPTIBLE TO SURFACE WATER FLOODING PLAN**

**AREAS SUSCEPTIBLE TO GROUND WATER FLOODING PLAN**

**FLOOD MAP FOR SURFACE WATER 1 IN 200 YEAR**

**FLOOD MAP FOR SURFACE WATER 1 IN 30 YEAR**

**EA FLOOD MAP**

**ANNEX 2: Records of future floods and their consequences** (preliminary assessment report spreadsheet)

| Field: | Flood ID | Description of assessment method | Name of Location | National Grid Reference | Location Description | Name | Flood modelled | Probability | Main source of flooding | Additional source(s) of flooding | Confidence in main source of flooding |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mandatory / optional: | **Mandatory** | **Mandatory** | **Mandatory** | **Mandatory** | Optional | Optional | Optional | **Mandatory** | **Mandatory** | Optional | Optional |
| Format: | Unique number between 1-9999 | Max 1,000 characters | Max 250 characters | 12 characters: 2 letters, 10 numbers | Max 250 characters | Max 250 characters | Max 250 characters | Max 25 characters | Pick from drop-down | Max 250 characters, same source terms | Pick from drop-down |
| Notes: | A sequential number starting at 1 and incrementing by 1 for each record. | Description of the future flood information and how it has been produced. Cover Regulation 12(6) requirements of (a) topography, (b) the location of watercourses, (c) the location of flood plains that retain flood water, (d) the characteristics of watercourses, and (e) the effectiveness of any works constructed for the purpose of flood risk management. Information from other relevant fields (Probability, Main source, Name) should be repeated here. | Name of the locality associated with the flood, using recognised postal address names such as streets, towns, counties. If the flood affects the whole LLFA, then record the name of the LLFA. | National Grid Reference of the centroid (centre point, falls within polygon) of the flood extent, or of the area affected if there is no extent information. If the flood affects the whole LLFA, then record the centroid of the LLFA. | A description of the general location that could be flooded. | Name of the model or map product or project which produced the future flood information | Background, or additional information on the probability of the flood modelled - such as whether Probability refers to probability of rainfall or water on the ground. | The chance of the flood occuring in any given year - record X from "a 1 in X chance of occurring in any given year". | Pick the source which generates the majority of flooding. Refer to the PFRA guidance for definitions of sources. | If the flood is generated by, or interacts with, any other sources (other than the Main source of flooding), report the source(s) here, using the same source terms. | Pick a broad level of confidence in the Main source of flooding from; 'High' (compelling evidence of source - about 80% confident that source is correct), 'Medium' (some evidence of source but not compelling - about 50% confident that source is correct) 'Low' (source assumed - about 20% confident that source is correct) or 'Unknown'. |
| Example: | 1 | See records below for examples of description of assessment method. | Essex | SX1234512345 | | Flood Map for Surface Water - 1 in 200 deep | Probability refers to the probability of the rainfall event, in this case producing flooding of greater than 0.3m depth. | 200 | Surface runoff | | High |
| Records begin here: | 1 | • Topography is derived from LIDAR (in larger urban areas, on 1, 2 and 3m grids; original accuracy ± 0.15m) and Geoperspective data (original accuracy ± 1.5m), processed to remove buildings and vegetation, then degraded to a composite 5m DTM. Manual edits applied where flow paths clearly omitted e.g. below bridges.<br>• Flow routes dictated by topography; no allowance made for manmade drainage. The DTM may miss flow paths below bridges.<br>• Areas that may flood are defined by dynamically routing a 6.5 hour duration storm with 1 in 200 chance of occurring in any year, over the DTM using JBA's JFLOW–GPU model.<br>• Manning's n of 0.1 is used throughout, to allow broad scale effects of buildings and other obstructions to be approximated.<br>• No allowance made for drainage, pumping or other works constructed for the purpose of flood risk management.<br>• The 'less susceptible' layer shows where modelled flooding is 0.1-0.3m deep; you must not interpret this as depth of flooding, rather as indicative of susceptibility to flooding because of modelling uncertainties | Solihull | 418932, 279649 | Throughout the borough, concentrated in urban areas | Areas Susceptible to Surface Water Flooding (AStSWF) - Less | Probability refers to the probability of the rainfall event. This identifies areas which are 'less susceptible' to surface water flooding. For more information refer to "What are Areas Susceptible to Surface Water Flooding" Environment Agency December 2010. | 200 | Surface runoff | | High |
| | 2 | • Topography is derived from LIDAR (in larger urban areas, on 1, 2 and 3m grids; original accuracy ± 0.15m) and Geoperspective data (original accuracy ± 1.5m), processed to remove buildings and vegetation, then degraded to a composite 5m DTM. Manual edits applied where flow paths clearly omitted e.g. below bridges.<br>• Flow routes dictated by topography; no allowance made for manmade drainage. The DTM may miss flow paths below bridges.<br>• Areas that may flood are defined by dynamically routing a 6.5 hour duration storm with 1 in 200 chance of occurring in any year, over the DTM using JBA's JFLOW–GPU model.<br>• Manning's n of 0.1 is used throughout, to allow broad scale effects of buildings and other obstructions to be approximated.<br>• No allowance made for drainage, pumping or other works constructed for the purpose of flood risk management.<br>• The 'intermediate susceptibility' layer shows where modelled flooding is 0.3-1.0m deep; you must not interpret this as depth of flooding, rather as indicative of susceptibility to flooding because of modelling uncertainties | Solihull | 418932, 279650 | Throughout the borough, concentrated in urban areas | Areas Susceptible to Surface Water Flooding (AStSWF) - Intermediate | Probability refers to the probability of the rainfall event. This identifies areas with 'intermediate susceptibility' to surface water flooding. | 200 | Surface runoff | | High |
| | 3 | • Topography is derived from LIDAR (in larger urban areas, on 1, 2 and 3m grids; original accuracy ± 0.15m) and Geoperspective data (original accuracy ± 1.5m), processed to remove buildings and vegetation, then degraded to a composite 5m DTM. Manual edits applied where flow paths clearly omitted e.g. below bridges.<br>• Flow routes dictated by topography; no allowance made for manmade drainage. The DTM may miss flow paths below bridges.<br>• Areas that may flood are defined by dynamically routing a 6.5 hour duration storm with 1 in 200 chance of occurring in any year, over the DTM using JBA's JFLOW–GPU model.<br>• Manning's n of 0.1 is used throughout, to allow broad scale effects of buildings and other obstructions to be approximated.<br>• No allowance made for drainage, pumping or other works constructed for the purpose of flood risk management.<br>• The 'more susceptible' layer shows where modelled flooding is >1.0m deep; you must not interpret this as depth of flooding, rather as indicative of susceptibility to flooding because of modelling uncertainties | Solihull | 418932, 279651 | Throughout the borough, concentrated in urban areas | Areas Susceptible to Surface Water Flooding (AStSWF) - More | Probability refers to the probability of the rainfall event. This identifies areas which are 'more susceptible' to surface water flooding. | 200 | Surface runoff | | High |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 4 | • Topography is derived from 64.5% LIDAR (on 0.25m-2m grids; original accuracy ± 0.15m) and 35.5% NEXTMap SAR (on 5m grid; original accuracy ± 1.0m), processed to remove buildings & vegetation, then combined on a 2m grid; buildings added with an arbitrary height of 5m based on OS MasterMap 2009 building footprints, then resampled to a 5m grid DTM. Manual edits applied where flow paths clearly omitted e.g. below bridges.<br>• Flow routes dictated by topography; a uniform allowance of 12mm/hr has been made for manmade drainage in urban areas. Infiltration allowance reduces runoff to 39% in rural areas and 70% in urban areas.<br>• Areas that may flood are defined by dynamically routing a 1.1 hour duration storm with 1 in 30 chance of occurring in any year over the DTM using JBA's JFLOW–GPU model.<br>• Manning's n of 0.1 in rural areas; 0.03 in urban areas, to reflect explicit modelling of buildings in urban areas.<br>• No allowance made for local variations in drainage, pumping or other works constructed for the purpose of flood risk management | Solihull | 418932, 279652 | Throughout the borough, concentrated in urban areas | Flood Map for Surface Water (FMfSW) - 1 in 30 | Probability refers to the probability of the rainfall event, in this case producing flooding of greater than 0.1m depth. | | 30 Surface runoff | High |
| 5 | • Topography is derived from 64.5% LIDAR (on 0.25m-2m grids; original accuracy ± 0.15m) and 35.5% NEXTMap SAR (on 5m grid; original accuracy ± 1.0m), processed to remove buildings & vegetation, then combined on a 2m grid; buildings added with an arbitrary height of 5m based on OS MasterMap 2009 building footprints, then resampled to a 5m grid DTM. Manual edits applied where flow paths clearly omitted e.g. below bridges.<br>• Flow routes dictated by topography; a uniform allowance of 12mm/hr has been made for manmade drainage in urban areas. Infiltration allowance reduces runoff to 39% in rural areas and 70% in urban areas.<br>• Areas that may flood are defined by dynamically routing a 1.1 hour duration storm with 1 in 30 chance of occurring in any year over the DTM using JBA's JFLOW–GPU model.<br>• Manning's n of 0.1 in rural areas; 0.03 in urban areas, to reflect explicit modelling of buildings in urban areas.<br>• No allowance made for local variations in drainage, pumping or other works constructed for the purpose of flood risk management | Solihull | 418932, 279653 | Throughout the borough, concentrated in urban areas | Flood Map for Surface Water (FMfSW) - 1 in 30 deep | Probability refers to the probability of the rainfall event, in this case producing flooding of greater than 0.3m depth. | | 30 Surface runoff | High |
| 6 | • Topography is derived from 64.5% LIDAR (on 0.25m-2m grids; original accuracy ± 0.15m) and 35.5% NEXTMap SAR (on 5m grid; original accuracy ± 1.0m), processed to remove buildings & vegetation, then combined on a 2m grid; buildings added with an arbitrary height of 5m based on OS MasterMap 2009 building footprints, then resampled to a 5m grid DTM. Manual edits applied where flow paths clearly omitted e.g. below bridges.<br>• Flow routes dictated by topography; a uniform allowance of 12mm/hr has been made for manmade drainage in urban areas. Infiltration allowance reduces runoff to 39% in rural areas and 70% in urban areas.<br>• Areas that may flood are defined by dynamically routing a 1.1 hour duration storm with 1 in 200 chance of occurring in any year over the DTM using JBA's JFLOW–GPU model.<br>• Manning's n of 0.1 in rural areas; 0.03 in urban areas, to reflect explicit modelling of buildings in urban areas.<br>• No allowance made for local variations in drainage, pumping or other works constructed for the purpose of flood risk management | Solihull | 418932, 279654 | Throughout the borough, concentrated in urban areas | Flood Map for Surface Water (FMfSW) - 1 in 200 | Probability refers to the probability of the rainfall event, in this case producing flooding of greater than 0.1m depth. | | 200 Surface runoff | High |
| 7 | • Topography is derived from 64.5% LIDAR (on 0.25m-2m grids; original accuracy ± 0.15m) and 35.5% NEXTMap SAR (on 5m grid; original accuracy ± 1.0m), processed to remove buildings & vegetation, then combined on a 2m grid; buildings added with an arbitrary height of 5m based on OS MasterMap 2009 building footprints, then resampled to a 5m grid DTM. Manual edits applied where flow paths clearly omitted e.g. below bridges.<br>• Flow routes dictated by topography; a uniform allowance of 12mm/hr has been made for manmade drainage in urban areas. Infiltration allowance reduces runoff to 39% in rural areas and 70% in urban areas.<br>• Areas that may flood are defined by dynamically routing a 1.1 hour duration storm with 1 in 200 chance of occurring in any year over the DTM using JBA's JFLOW–GPU model.<br>• Manning's n of 0.1 in rural areas; 0.03 in urban areas, to reflect explicit modelling of buildings in urban areas.<br>• No allowance made for local variations in drainage, pumping or other works constructed for the purpose of flood risk management | Solihull | 418932, 279655 | Throughout the borough, concentrated in urban areas | Flood Map for Surface Water (FMfSW) - 1 in 200 deep | Probability refers to the probability of the rainfall event, in this case producing flooding of greater than 0.3m depth. | | 200 Surface runoff | High |
| 8 | • Areas Susceptible to Groundwater Flooding (AStGWF) is a strategic scale map showing groundwater flood areas on a 1km square grid<br>• This data has used the top two susceptibility bands of the British Geological Society (BGS) 1:50,000 Groundwater Flood Susceptibility Map, which was developed on a 50m grid from:<br>• NEXTMap 5m grid DTM.<br>• National Groundwater Level data on a 50m grid<br>• BGS 1:50 000 geological mapping, with classifications of permeability<br>• It covers consolidated aquifers (chalk, limestone, sandstone etc.) and superficial deposits.<br>• Flood plains are not explicitly identified; the mapping identifies where groundwater is likely to emerge, and not where the water is subsequently likely to flow or pond.<br>• No allowance is made for engineering works, or for groundwater rebound or abstraction to prevent groundwater rebound.<br>• Shows the proportion of each 1km grid square which is susceptible to groundwater emergence, using four area categories | Solihull | 418932, 279656 | Throughout the borough | Areas Susceptible to Groundwater Flooding (AStGWF) | Does not describe a probability, but shows places where groundwater emergence more likely to occur. | Unknown | Groundwater | High |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 9 | • Modelling developed from combination of national (2004) and local (generally 1998-2010) modelling.<br>• Topography derived from LIDAR (on 0.25m-2m grids; original accuracy ± 0.15m), NEXTMap SAR (on 5m grid; original accuracy ± 1.0m), processed to remove buildings & vegetation. For local modelling, topography may include ground survey.<br>• Location of watercourses and tidal flow routes dictated by topographic survey.<br>• Areas that may flood are defined for catchments >3km² by routing appropriate flows for that catchment through the model to ascertain water level and thus depth and extent.<br>• Manning's n of 0.1 used for national fluvial modelling; variable (calibrated) values for national tidal modelling; appropriate values selected for local modelling. Channel capacity assumed as QMED for national fluvial modelling; local survey methods used for local modelling.<br>• For the purpose of flood risk management, models assume that there are no raised defences | Solihull | 418932, 279657 | Following the main rivers, Blythe and Cole in the northern and eastern parts of the borough | Flood Map (for rivers and sea) - flood zone 3 | Fluvial 1 in 100, tidal 1 in 200 | 100 Main rivers | Sea, ordinary watercourses | Medium |
| 10 | • Modelling developed from combination of national (2004) and local (generally 2004-2010) modelling.<br>• Topography derived from LIDAR (on 0.25m-2m grids; original accuracy ± 0.15m), NEXTMap SAR (on 5m grid; original accuracy ± 1.0m), processed to remove buildings & vegetation. For local modelling, topography may include ground survey.<br>• Location of watercourses and tidal flow routes dictated by topographic survey.<br>• Areas that may flood are defined for catchments >3km² by routing appropriate flows for that catchment through the model to ascertain water level and thus depth and extent.<br>• Manning's n of 0.1 used for national fluvial modelling; variable (calibrated) values for national tidal modelling; appropriate values selected for local modelling. Channel capacity assumed as QMED for national fluvial modelling; local survey methods used for local modelling.<br>• For the purpose of flood risk management, models assume that there are no raised defences | Solihull | 418932, 279658 | Following the main rivers, Blythe and Cole in the northern and eastern parts of the borough | Flood Map (for rivers and sea) - flood zone 2 | Extreme flood outline is 1 in 1000, and includes some historic where judged that this gives an indication of areas at risk of future flooding. | 1000 Main rivers | Sea, ordinary watercourses | Medium |

| Main mechanism of flooding | Main characteristic of flooding | Significant consequences to human health | Human health consequences - residential properties | Property count method | Other human health consequences | Significant economic consequences | Number of non-residential properties flooded | Property count method | Other economic consequences | Significant consequences to the environment | Environment consequences | Significant consequences to cultural heritage | Cultural heritage consequences |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mandatory | Mandatory | Mandatory | Optional | Optional | Optional | Mandatory | Optional | Optional | Optional | Mandatory | Optional | Mandatory | Optional |
| Pick from drop-down | Pick from drop-down | Pick from drop-down | Number between 1-10,000,000 | Pick from drop-down | Max 250 characters | Pick from drop-down | Number between 1-10,000,000 | Pick from drop-down | Max 250 characters | Pick from drop-down | Max 250 characters | Pick from drop-down | Max 250 characters |
| Pick a mechanism from; 'Natural exceedance' (of capacity), 'Defence exceedance' (floodwater overtopping defences), 'Failure' (of natural or artificial defences or infrastructure, or of pumping), 'Blockage or restriction' (natural or artificial blockage or restriction of a conveyance channel or system), or 'No data'. | Pick a characteristic from; 'Flash flood' (rises and falls quite rapidly with little or no advance warning), 'Natural flood' (due to significant precipitation, at a slower rate than a flash flood), 'Snow melt flood' (due to rapid snow melt), 'Debris flow' (conveying a high degree of debris), or 'No data'. Most UK floods are 'Natural floods'. | Would there be any significant consequences to human health if the future flood were to occur? | Record the number of residential properties where the building structure would be affected either internally or externally if the flood were to occur. | Where residential or non-residential properties have been counted, it is important to record the method of counting, to aid comparisons between counts. Choose from; 'Detailed GIS' (using property outlines, as per Environment Agency guidance), 'Simple GIS' (using property points), 'Estimate from map', or 'Observed number'. | If there would be other Significant consequences to human health, describe them including information such as the number of critical services flooded. | Would there be any significant economic consequences if the future flood were to occur? | Record the number of non-residential properties where the building structure would be affected either internally or externally if the flood were to occur. | Where residential or non-residential properties have been counted, it is important to record the method of counting, to aid comparisons between counts. Choose from; 'Detailed GIS' (using property outlines, as per Environment Agency guidance), 'Simple GIS' (using property points), 'Estimate from map', or 'Observed number'. | If there would be other Significant economic consequences, describe them including information such as the area of agricultural land flooded, length of roads and rail flooded. | Would there be any significant consequences to the environment if the future flood were to occur? | If there would be Significant consequences to the environment, describe them including information such as national and international designated sites flooded, and pollution sources flooded. | Would there be any significant consequences to cultural heritage if the future flood were to occur? | If there would be Significant consequences to cultural heritage, describe them including information such as the number and type of heritage assets flooded. |
| Natural exceedance | Natural flood | Yes | 12000 | Detailed GIS | | No | | | | No | | No | |
| Natural exceedance | Natural flood | | Available from EA | | | | Available from EA | | | | | | |
| Natural exceedance | Natural flood | | Available from EA | | | | Available from EA | | | | | | |
| Natural exceedance | Natural flood | | | | | | | | | | | | |

| | | | | |
|---|---|---|---|---|
| Natural exceedance | Natural flood | | | |
| Natural exceedance | Natural flood | | | |
| Natural exceedance | Natural flood | Available from EA | Available from EA | |
| Natural exceedance | Natural flood | Available from EA | Available from EA | |
| Natural exceedance | Natural flood | | | |

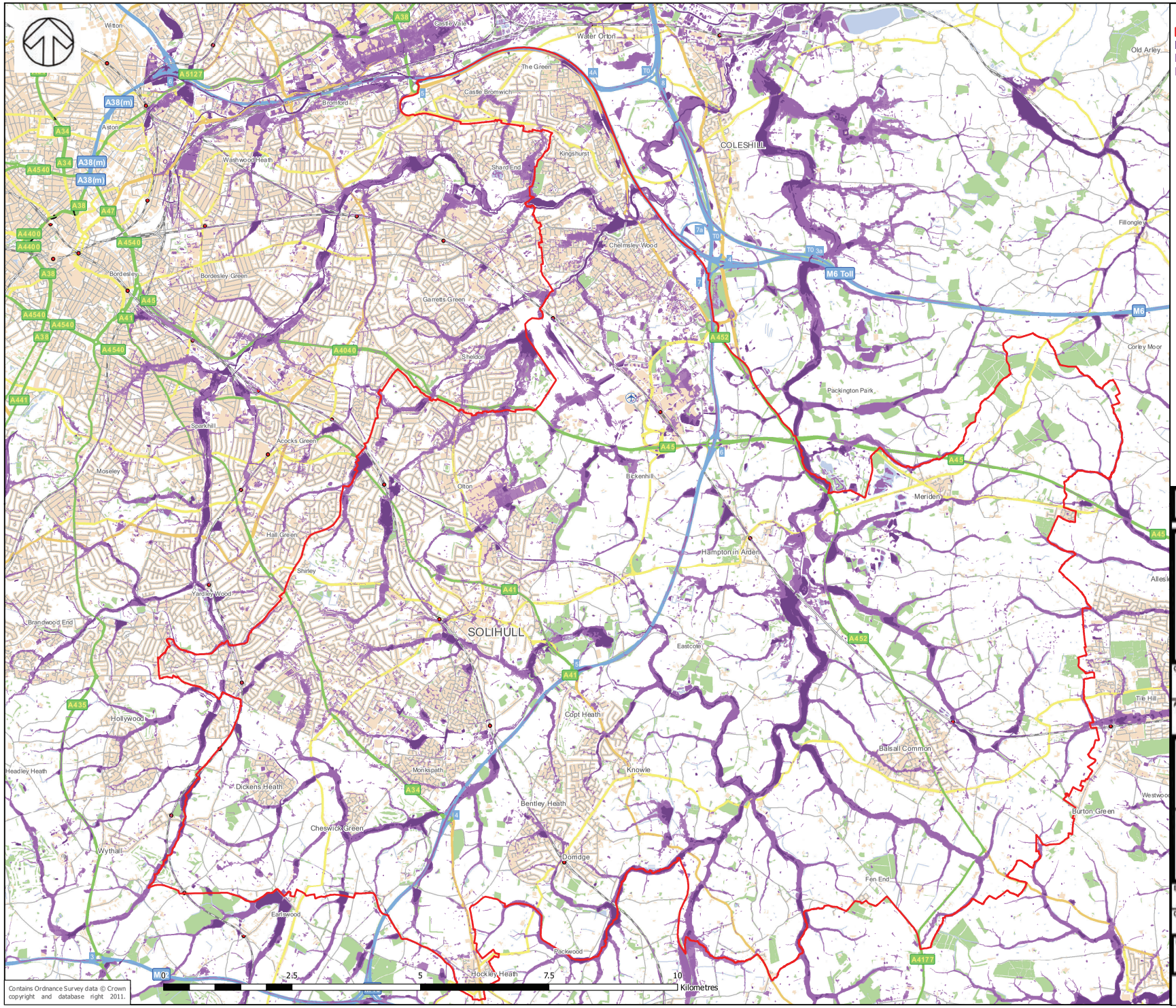
Natural exceedance Natural flood

Natural exceedance Natural flood

| Comments | Data owner | Area flooded | Confidence in modelled outline | Model date | Model Type | Hydrology Type | Lineage | Sensitive data | Protective marking descriptor | European Flood Event Code |
|---|---|---|---|---|---|---|---|---|---|---|
| Optional<br>Max 1,000 characters<br><br>Any additional comments about the future flood record. | Optional<br>Max 250 characters | Optional<br>Number with two decimal places<br>The total area of the land flooded, in $km^2$ | Optional<br>Pick from drop-down<br><br>Pick a broad level of confidence in the modelled flood outline from; 'High' (good match to past flood extents - about 80% confident that outline is correct), 'Medium' (reasonable match - about 50% confident that outline is correct), 'Low' (poor match, sparse data - about 20% confident that outline is correct) or 'Unknown'. | Optional<br>'yyyy' or 'yyyy-mm' or 'yyyy-mm-dd' | Optional<br>Max 250 characters<br><br>Type of software used to create future flood information. | Optional<br>Max 250 characters<br><br>Type of hydrology method used to create future flood information. | Optional<br>Max 250 characters<br><br>Lineage is how and what the data is made from. Has this data been created by using data owned or derived from data owned by 3rd party (external) organisations? If yes please give details. | Optional<br>Pick from drop-down<br><br>Has the information been classified under the Government's Protective Marking Scheme? Include protective marking time limit where known. Note: If "Approved for Access" then report "Unmarked". | Optional<br>Max 50 characters<br><br>For use where organisations apply the Government's Protective Marking Scheme. | Auto-populated<br>Max 42 characters<br><br>This field will autopopulate using the LLFA name provided on the "Instructions" tab, and the Flood ID. It is an EU-wide unique identifier and will be used to report the flood information.<br><br>Format: UK<ONS Code><P or F><LLFA Flood ID>. "ONS Code" is a unique reference for each LLFA. "P or F" indicates if the event is past or future. "LLFA Flood ID" is a sequential number beginning with 0001. |
| | Epping Forest District Council | | Medium-Low | 2008-08 | 2D-TuFlow | FEH (Revised Rainfall Runoff) | Ordnance Survey AddressPoint; CEH 1:50k River Centreline; NextMap DTM. | Unmarked | Private | UKE10000012F0001 |
| | JBA Consulting (distributed by Environment Agency under licence) | | Low | 2009-07 | JFLOW-GPU | Depth-duration-frequency curves derived from FEH CD-ROM, from centre of each 5km model, with areal reduction factor applied to convert point rainfall estimate to more representative figure. Curve then used to derive 6.5 hr, 1:200 chance rainfall depth; this is converted to hyetograph, using summer rainfall profile. | | Protect | Commercial | UKE09000002F0001 |
| | JBA Consulting (distributed by Environment Agency under licence) | | Low | 2009-07 | JFLOW-GPU | Depth-duration-frequency curves derived from FEH CD-ROM, from centre of each 5km model, with areal reduction factor applied to convert point rainfall estimate to more representative figure. Curve then used to derive 6.5 hr, 1:200 chance rainfall depth; this is converted to hyetograph, using summer rainfall profile. | | Protect | Commercial | UKE09000002F0002 |
| | JBA Consulting (distributed by Environment Agency under licence) | | Low | 2009-07 | JFLOW-GPU | Depth-duration-frequency curves derived from FEH CD-ROM, from centre of each 5km model, with areal reduction factor applied to convert point rainfall estimate to more representative figure. Curve then used to derive 6.5 hr, 1:200 chance rainfall depth; this is converted to hyetograph, using summer rainfall profile. | | Protect | Commercial | UKE09000002F0003 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Environment Agency | Medium-Low | 2010-11 | JFLOW-GPU | Depth-duration-frequency curves derived from FEH CD-ROM, from centre of each 5km model, with areal reduction factor applied to convert point rainfall estimate to more representative figure. Curve then used to derive 1.1 hr, 1:30 chance rainfall depth; this is converted to hyetograph, using summer rainfall profile. See "Description of assessment method" for allowances for infiltration and drainage. | Rainfall Hyetograph, EA 2m Composite DTM, OSMM Topography | Unmarked | UKE09000002F0004 |
| | Environment Agency | Medium-Low | 2010-11 | JFLOW-GPU | Depth-duration-frequency curves derived from FEH CD-ROM, from centre of each 5km model, with areal reduction factor applied to convert point rainfall estimate to more representative figure. Curve then used to derive 1.1 hr, 1:30 chance rainfall depth; this is converted to hyetograph, using summer rainfall profile. See "Description of assessment method" for allowances for infiltration and drainage. | Rainfall Hyetograph, EA 2m Composite DTM, OSMM Topography | Unmarked | UKE09000002F0005 |
| | Environment Agency | Medium-Low | 2010-11 | JFLOW-GPU | Depth-duration-frequency curves derived from FEH CD-ROM, from centre of each 5km model, with areal reduction factor applied to convert point rainfall estimate to more representative figure. Curve then used to derive 1.1 hr, 1:200 chance rainfall depth; this is converted to hyetograph, using summer rainfall profile. See "Description of assessment method" for allowances for infiltration and drainage. | Rainfall Hyetograph, EA 2m Composite DTM, OSMM Topography | Unmarked | UKE09000002F0006 |
| | Environment Agency | Medium-Low | 2010-11 | JFLOW-GPU | Depth-duration-frequency curves derived from FEH CD-ROM, from centre of each 5km model, with areal reduction factor applied to convert point rainfall estimate to more representative figure. Curve then used to derive 1.1 hr, 1:200 chance rainfall depth; this is converted to hyetograph, using summer rainfall profile. See "Description of assessment method" for allowances for infiltration and drainage. | Rainfall Hyetograph, EA 2m Composite DTM, OSMM Topography | Unmarked | UKE09000002F0007 |
| Data developed specifically for PFRA, and is unlikely to be suitable for any other purposes. | Environment Agency | Low | 2010-11 | ArcGIS | Uses data which is developed from published BGS groundwater level contours, groundwater levels in BGS WellMaster database and some river levels. No probability is associated with this data. | British Geological Society (BGS) DiGMapGB-50 [Susceptibility to Groundwater Flooding]. | Unmarked | UKE09000002F0008 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Data updated quarterly. To understand the likelihood of future flooding, taking account of defences, refer to Areas Benefitting from Defences and National Flood Risk Assessment (NaFRA) data. Marked 'Protect' for complete national dataset only. | Environment Agency | Medium | 2010-11 | Varies but mainly JFLOW, ISIS, HEC-RAS, TUFLOW for fluvial, and HYDROF for tidal. | National methodology described in "National Generalised Modelling for Flood Zones - Fluvial & Tidal Modelling Methods - Methodology, Strengths and Limitations". A national dataset (for England and Wales) of fluvial flood peak estimates was derived from the Flood Estimation Handbook (FEH) to generate a 1 in 100 chance fluvial flood. Local fluvial modelling uses FEH methods. Peak tidal water levels from either Dixon & Tawn (DT3) or local data sets to derive 1 in 200 chance tide levels including surge from POL CSX model. | NextMap SAR DTMe, UKHO Admiralty Charts, 1:50K CEH River Centre Line, CEH FEH Q(T) Grids, POL CSX Peak Extreme Water Levels, POL CS3 Astronomical Tides, UKHO Admiralty Tide Time-Series Calibration Locations, OS 1:10 Boundary Line MHW | Protect | Commercial | UKE09000002F0009 |
| Data updated quarterly. To understand the likelihood of future flooding, taking account of defences, refer to National Flood Risk Assessment (NaFRA) data. Marked 'Protect' for complete national dataset only. | Environment Agency | Medium | 2010-11 | Varies but mainly JFLOW, ISIS, HEC-RAS, TUFLOW for fluvial, and HYDROF for tidal. | National methodology described in "National Generalised Modelling for Flood Zones - Fluvial & Tidal Modelling Methods - Methodology, Strengths and Limitations". A national dataset (for England and Wales) of fluvial flood peak estimates was derived from the Flood Estimation Handbook (FEH) to generate a 1 in 1000 chance fluvial flood. Local fluvial modelling uses FEH methods. Peak tidal water levels from either Dixon & Tawn (DT3) or local data sets to derive 1 in 1000 chance tide levels including surge from POL CSX model. | NextMap SAR DTMe, UKHO Admiralty Charts, 1:50K CEH River Centre Line, CEH FEH Q(T) Grids, POL CSX Peak Extreme Water Levels, POL CS3 Astronomical Tides, UKHO Admiralty Tide Time-Series Calibration Locations, OS 1:10 Boundary Line MHW, Historic | Protect | Commercial | UKE09000002F0010 |






KEY

- Borough Outline
- AStSW More
- AStSW Intermediate
- AStSW Less

DRAWING STATUS: FOR INFORMATION

WSP

Property & Development, Colston 33, Colston Avenue, Bristol, BS1 4UA

Tel: +44 (0)117 930 2000
Fax: +44 (0)117 929 4624
http://www.wspgroup.com

CLIENT: SOLIHULL METROPOLITAN BOROUGH COUNCIL

ARCHITECT:

PROJECT: SOLIHULL METROPOLITAN BOROUGH COUNCIL PRELIMINARY FLOOD RISK ASSESSMENT

TITLE: AREAS SUSCEPTIBLE TO SURFACE WATER (ASTSW)

| SCALE @ A1 | CHECKED | APPROVED |
|---|---|---|
| 1:50,000 | CHK | OH |
| **CAD FILE** | **DESIGN DRAWN** | **DATE** |
| AStSW | EJO | MARCH 2011 |
| **PROJECT No** | **DRAWING No** | **REV** |
| 10260095 | PFRA APP B | A |



Drawn By: ukaxp020

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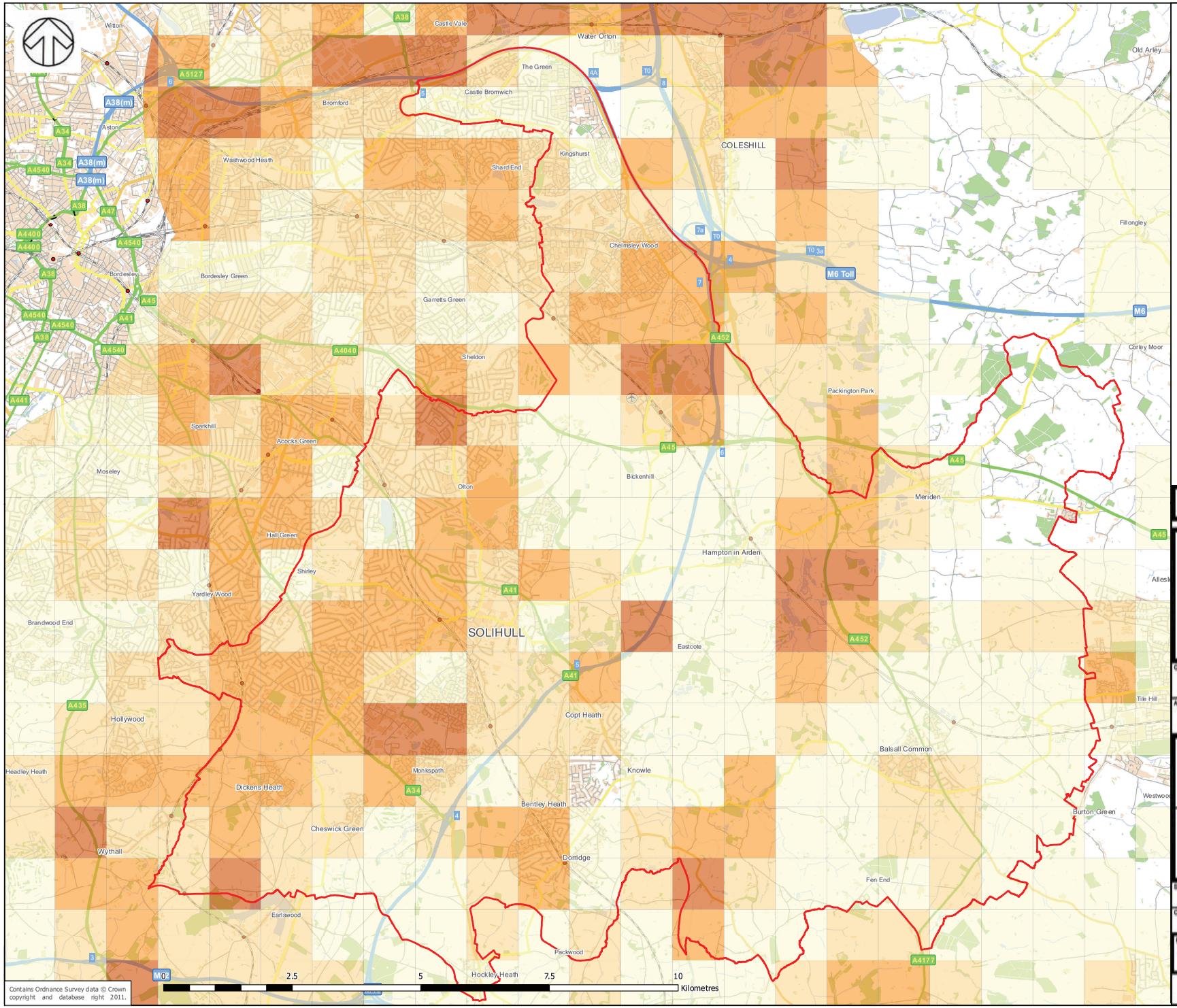


Drawn By: ukaxp020

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DRAWING STATUS:
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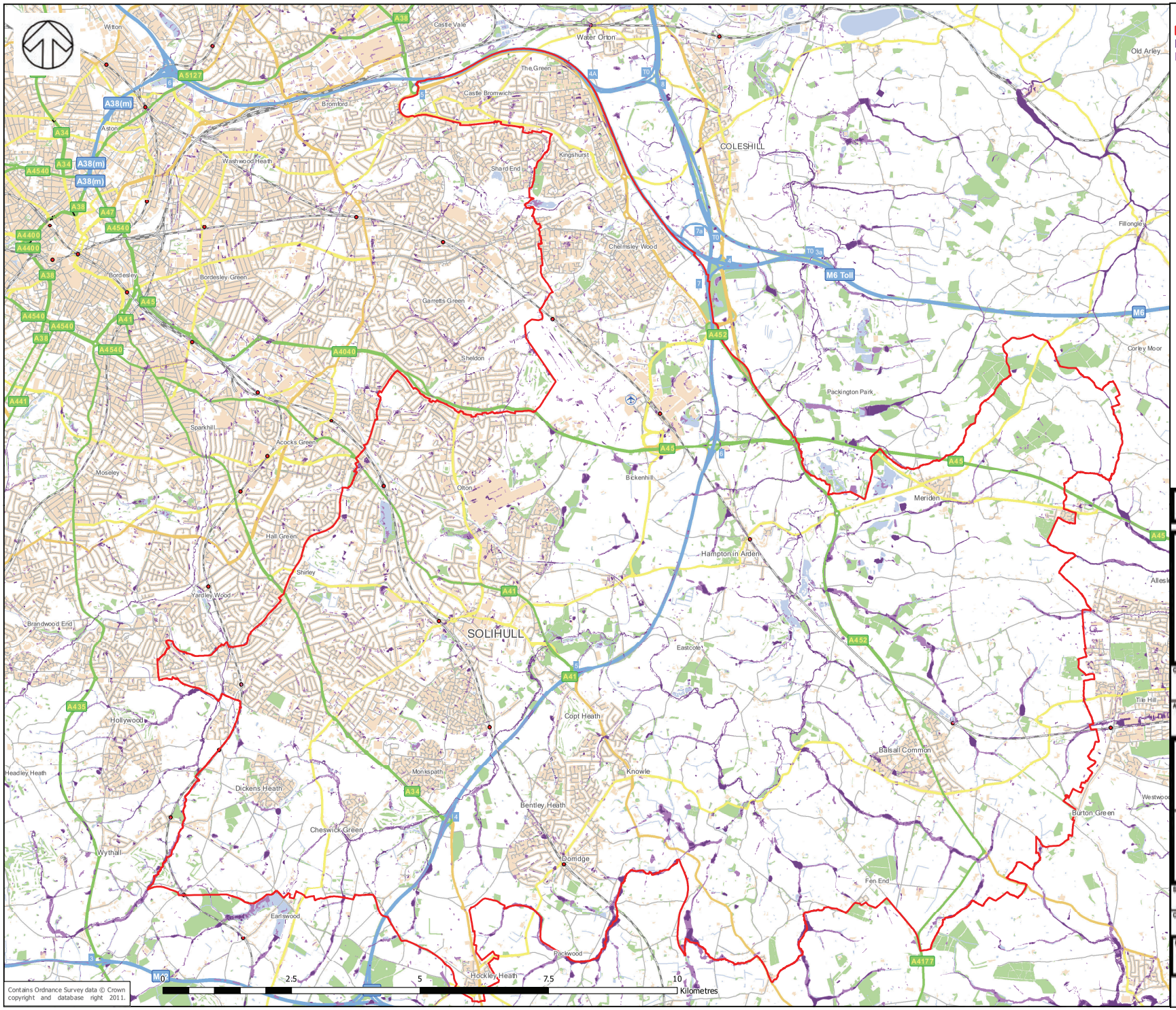
CLIENT:
SOLIHULL METROPOLITAN BOROUGH COUNCIL

ARCHITECT:

PROJECT:
SOLIHULL METROPOLITAN BOROUGH COUNCIL PRELIMINARY FLOOD RISK ASSESSMENT

TITLE:
AREAS SUSCEPTIBLE TO GROUND WATER FLOODING (ASTGW)

| SCALE @ A1: | CHECKED: | APPROVED: |
|---|---|---|
| 1:50,000 | CHK | OH |
| CAD FILE: | DESIGN DRAWN: | DATE: |
| ASTGW | EJO | MARCH 2011 |
| PROJECT No: | DRAWING No: | REV: |
| 10260095 | PFRA APP B | A |




Drawn By: ukaxp020

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KEY

- Borough Outline
- FMfSW 30 yr > 0.3m
- FMfSW 30 yr > 0.1m

DRAWING STATUS:
FOR INFORMATION


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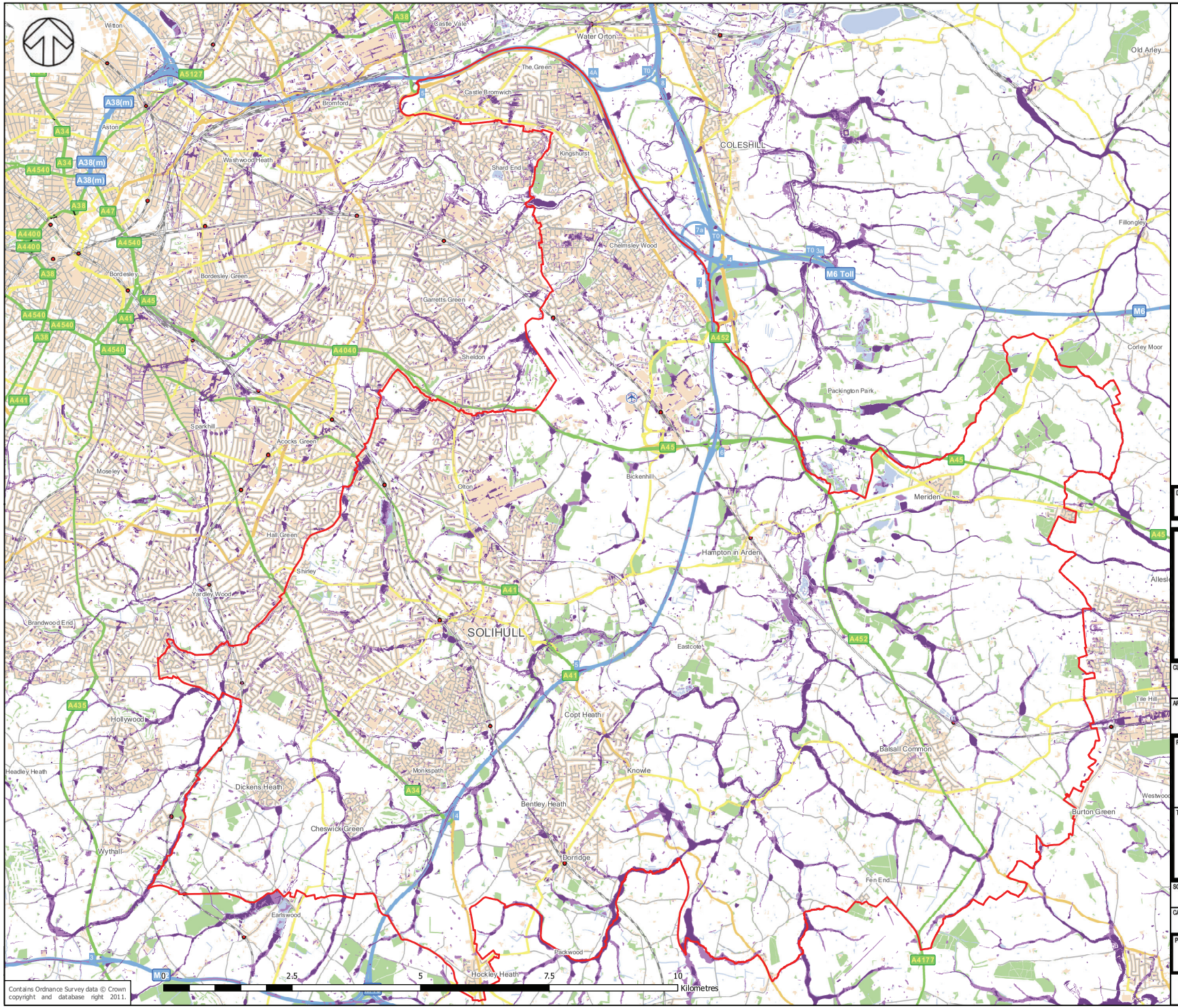
CLIENT:
SOLIHULL METROPOLITAN BOROUGH COUNCIL

ARCHITECT:

PROJECT:
SOLIHULL METROPOLITAN BOROUGH COUNCIL PRELIMINARY FLOOD RISK ASSESSMENT

TITLE:
FLOOD MAP FOR SURFACE WATER (FMFSW) 1 IN 30 YEAR PREDICTED EVENT

| SCALE @ A1: | CHECKED: | APPROVED: |
|---|---|---|
| 1:50,000 | CHK | OH |
| CAD FILE: | DESIGN DRAWN: | DATE: |
| FMFSW 30 | EJO | MARCH 2011 |
| PROJECT No: | DRAWING No: | REV: |
| 11260095 | PFRA APP B | A |




KEY

- Borough Outline
- FMfSW 200 yr > 0.3m
- FMfSW 200 yr > 0.1m

DRAWING STATUS: FOR INFORMATION

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CLIENT: SOLIHULL METROPOLITAN BOROUGH COUNCIL

ARCHITECT:

PROJECT: SOLIHULL METROPOLITAN BOROUGH COUNCIL PRELIMINARY FLOOD RISK ASSESSMENT

TITLE: FLOOD MAP FOR SURFACE WATER (FMFSW) 1 IN 200 YEAR PREDICTED EVENT

| SCALE @ A1: | CHECKED: | APPROVED: |
|---|---|---|
| 1:50,000 | CHK | OH |
| CAD FILE: | DESIGN-DRAWN: | DATE: |
| ASTGW | EJO | MARCH 2011 |
| PROJECT No: | DRAWING No: | REV: |
| 10260095 | PFRA APP B | A |



Drawn By: ukaxp020

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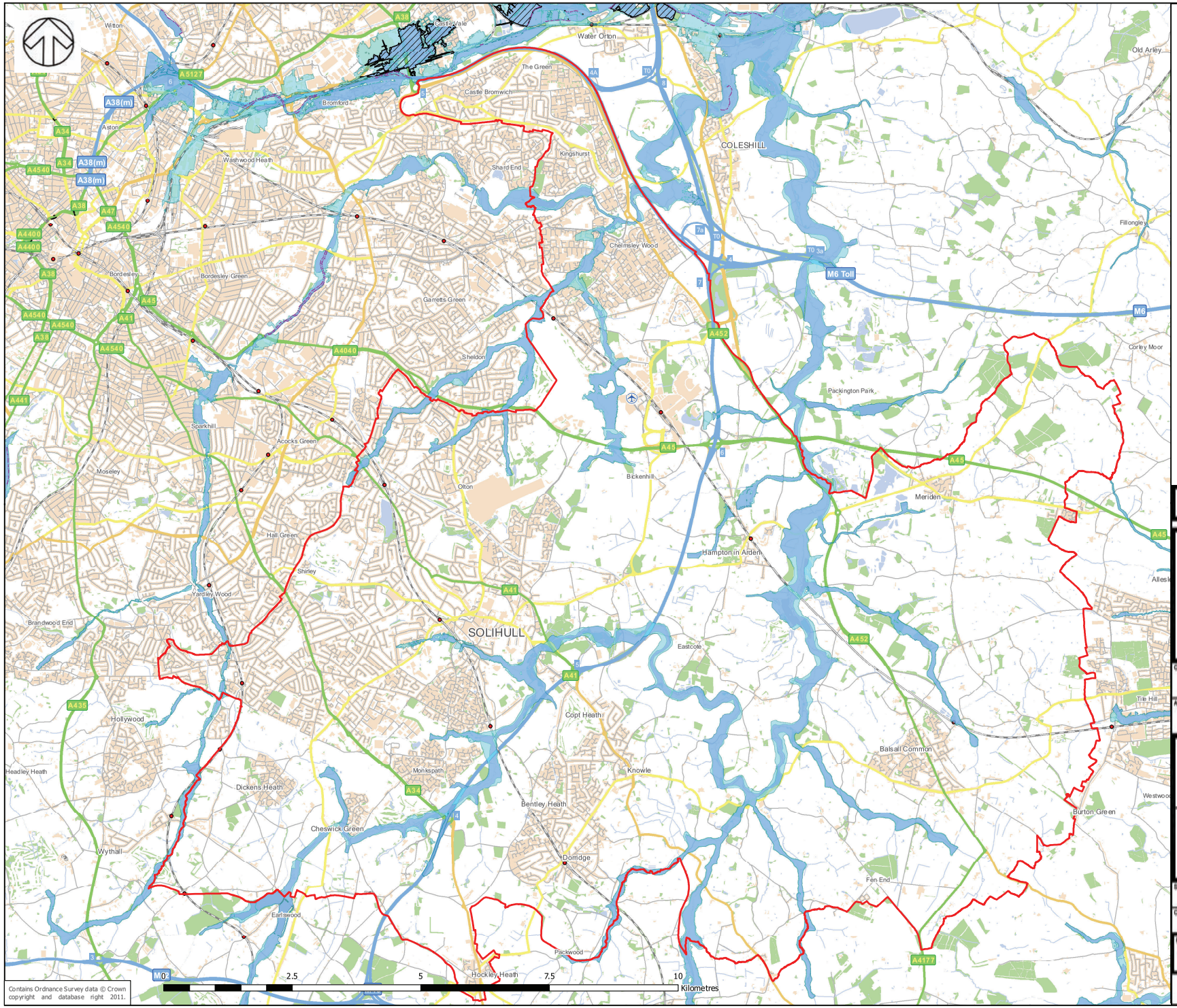


Drawn By: ukaxp020

File: Q:\WSP_UK\WSP_D\Bristol\Projects\10260095 - Solihul PFRA\Figures\DWG FOR PFRA\FLOOD MAP.mxd

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http://www.wspgroup.com

CLIENT:
SOLIHULL METROPOLITAN BOROUGH COUNCIL

ARCHITECT:

PROJECT:
SOLIHULL METROPOLITAN BOROUGH COUNCIL PRELIMINARY FLOOD RISK ASSESSMENT

TITLE:
ENVIRONMENT AGENCY FLOOD MAP

| SCALE @ A1: | CHECKED: | APPROVED: |
|---|---|---|
| 1:50,000 | CHK | OH |
| CAD FILE: | DESIGN DRAWN: | DATE: |
| EAFM | EJO | MARCH 2011 |
| PROJECT No: | DRAWING No: | REV: |
| 10260095 | PFRA APP B | A |

# Appendix C Records of Flood Risk Areas and their Rationale

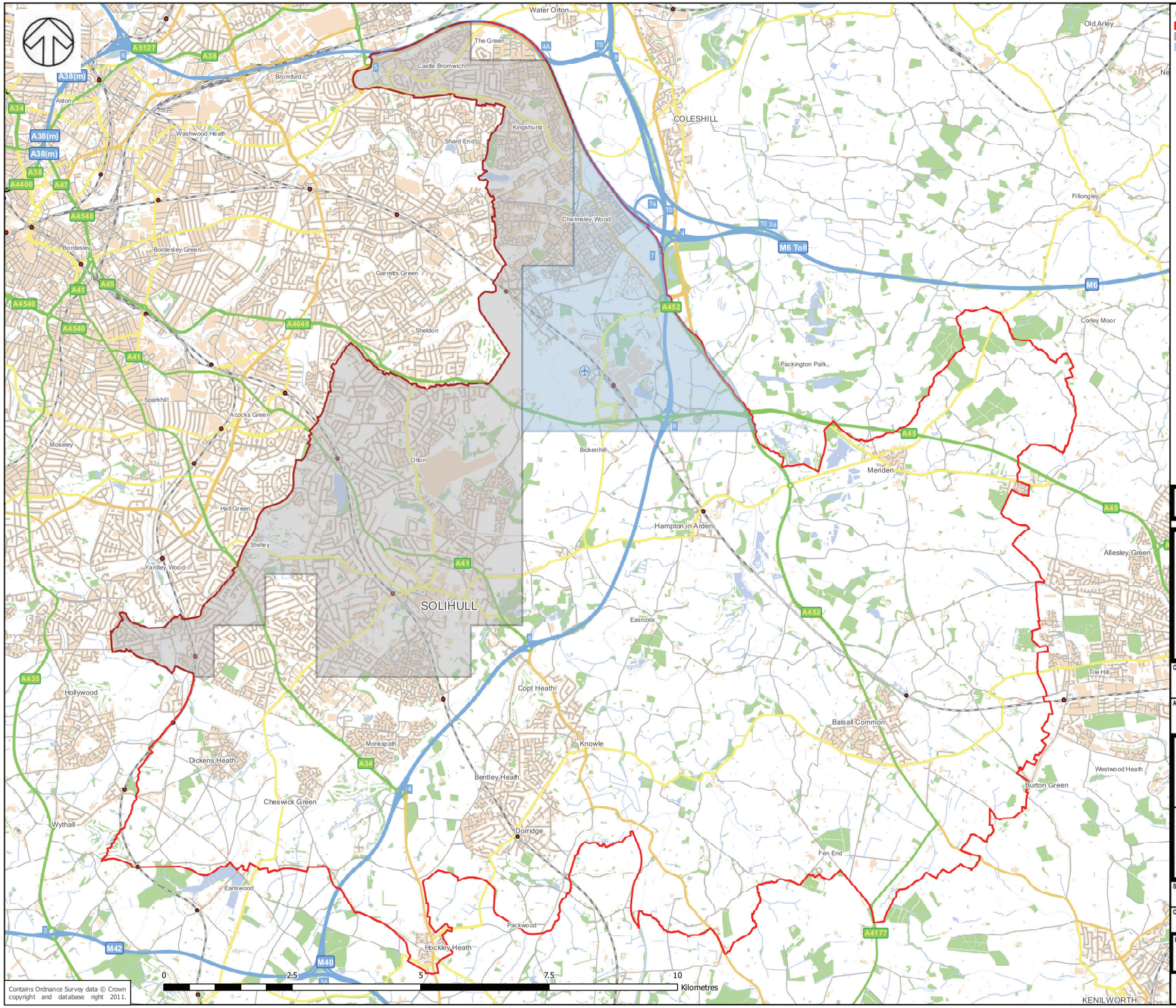
**PRELIMINARY FLOOD RISK ASSESSEMENT SPREAD SHEET**

**INDICATIVE FLOOD RISK AREAS - SOLIHULL**

**ANNEX 3: Records of Flood Risk Areas and their rationale** (preliminary assessment report spreadsheet)

| Field: | **Flood Risk Area ID** | **Name of Flood Risk Area** | **National Grid Reference** | **Main source of flooding** | Additional source(s) of flooding | Confidence in main source of flooding | **Main mechanism of flooding** | **Main characteristic of flooding** | **Significant consequences to human health** | Human health consequences - residential properties | Property count method | Other human health consequences | **Significant economic consequences** | Number of non-residential properties flooded |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mandatory / optional: | **Mandatory** | **Mandatory** | **Mandatory** | **Mandatory** | Optional | Optional | **Mandatory** | **Mandatory** | **Mandatory** | Optional | Optional | Optional | **Mandatory** | Optional |
| Format: | Unique number between 1-9999 | Max 250 characters | 12 characters: 2 letters, 10 numbers | Pick from drop-down | Max 250 characters, same source terms | Pick from drop-down | Pick from drop-down | Pick from drop-down | Pick from drop-down | Number between 1-10,000,000 | Pick from drop-down | Max 250 characters | Pick from drop-down | Number between 1-10,000,000 |
| Notes: | A sequential number starting at 1 and incrementing by 1 for each record. | Name of the locality associated with the Flood Risk Area; a town, city, or county. | National Grid Reference of the centroid (centre point, falls within polygon) of the Flood Risk Area. | Pick the source from which there is a significant flood risk. Refer to the PFRA guidance for definitions of sources. | If there is also significant flood risk generated by another source (other than the Main source of flooding), report the source(s) here, using the same source terms. | Pick a broad level of confidence in the Main source of flooding from; 'High' (compelling evidence of source - about 80% confident that source is correct), 'Medium' (some evidence of source but not compelling - about 50% confident that source is correct) 'Low' (source assumed - about 20% confident that source is correct) or 'Unknown'. | Pick a mechanism from; 'Natural exceedance' (of capacity), 'Defence exceedance' (floodwater overtopping defences), 'Failure' (of natural or artificial defences or infrastructure, or of pumping), 'Blockage or restriction' (natural or artificial blockage or restriction of a conveyance channel or system), or 'No data'. | Pick a characteristic from; 'Flash flood' (rises and falls quite rapidly with little or no advance warning), 'Natural flood' (due to significant precipitation, at a slower rate than a flash flood), 'Snow melt flood' (due to rapid snow melt), 'Debris flow' (conveying a high degree of debris), or 'No data'. Most UK floods are 'Natural floods'. | Has the Flood Risk Area been identified as a result of significant consequences to human health? | Record the number of residential properties where the building structure would be affected either internally or externally by the flood. | Where residential or non-residential properties have been counted, it is important to record the method of counting, to aid comparisons between counts. Choose from; 'Detailed GIS' (using property outlines, as per Environment Agency guidance), 'Simple GIS' (using property points), 'Estimate from map', or 'Observed number'. | If the Flood Risk Area has been identified as a result of other Significant consequences to human health, describe them (such as information about the number of critical services flooded). | Has the Flood Risk Area been identified as a result of significant economic consequences? | Record the number of non-residential properties where the building structure would be affected either internally or externally by the flood. |
| Example: | 1 | London | SX1234512345 | Surface runoff | NA | High | Natural exceedance | Natural flood | Yes | 50000 | Detailed GIS | | No | |
| Records begin here: | 1 | Solihull | 418932, 279649 | Surface runoff | Significant risk of flooding identified within west of borough from predominantly surface water | High | Natural exceedance | Natural flood | Yes | Approximately 7000 flooded to a depth in excess of 0.3m | Detailed GIS | Approximately 20 critical services flooded to in excess of 0.3m | Yes | approximately 400 non residential properties flooded to in excess of 0.3m |

| Property count method | Other economic consequences | **Significant consequences to the environment** | Environment consequences | **Significant consequences to cultural heritage** | Cultural heritage consequences | **Origin of Flood Risk Area** | **Amended Flood Risk Area rationale** | **New Flood Risk Area rationale** | **Rationale detail** | European Flood Risk Area Code |
|---|---|---|---|---|---|---|---|---|---|---|
| Optional<br>Pick from drop-down | Optional<br>Max 250 characters | **Mandatory**<br>Pick from drop-down | Optional<br>Max 250 characters | **Mandatory**<br>Pick from drop-down | Optional<br>Max 250 characters | **Mandatory**<br>Pick from drop-down | **Mandatory**<br>Pick from drop-down | **Mandatory**<br>Pick from drop-down | **Mandatory**<br>Max 1,000 characters | Auto-populated<br>Max 42 characters |
| Where residential or non-residential properties have been counted, it is important to record the method of counting, to aid comparisons between counts. Choose from; 'Detailed GIS' (using property outlines, as per Environment Agency guidance), 'Simple GIS' (using property points), 'Estimate from map', or 'Observed number'. | If the Flood Risk Area has been identified as a result of other Significant economic consequences, describe them (such as information about the area of agricultural land flooded, length of roads and rail flooded). | Has the Flood Risk Area been identified as a result of significant consequences to the environment? | If the Flood Risk Area has been identified as a result of Significant consequences to the environment, describe them (such as information about national and international designated sites flooded, and pollution sources flooded). | Has the Flood Risk Area been identified as a result of significant consequences to cultural heritage? | If the Flood Risk Area has been identified as a result of Significant consequences to cultural heritage, describe them (such as information about the number and type of heritage assets flooded). | Pick the origin from either; 'Indicative' Flood Risk Area, 'Amended' Flood Risk Area (in which case Amended Flood Risk Area rationale is mandatory), or 'New' Flood Risk Area (in which case New Flood Risk Area rationale is mandatory). | Pick the main rationale from either; 'Geography', 'Past floods', or 'Future floods'. Then provide further detail in Rationale detail. This is not mandatory if the Flood Risk Area was an indicative Flood Risk Area and has not been amended, or is a new Flood Risk Area. | Pick the main rationale from either 'Past floods', or 'Future floods'. Then provide further detail in Rationale detail. This is not mandatory if the Flood Risk Area was an indicative Flood Risk Area. | Summarise the rationale for amending an indicative Flood Risk Area, or identifying a new Flood Risk Area. Refer to Defra & WAG guidance to LLFAs on "Selecting and reviewing Flood Risk Areas for local sources of flooding". If the Flood Risk Area was an indicative Flood Risk Area and has not been amended, record "indicative Flood Risk Area". | This field will autopopulate using the LLFA name provided on the "Instructions" tab, and the Flood Risk Area ID. It is an EU-wide unique identifier and will be used to report the Flood Risk Area information.<br><br>Format: UK<ONS Code><A><LLFA Flood ID>. "ONS Code" is a unique reference for each LLFA. "A" indicates it is a Flood Risk Area. "LLFA Flood ID" is a sequential number beginning with 0001. |
| | | No | | No | | Indicative | NA | NA | indicative Flood Risk Area | UKE10000012A0001 |
| Detailed GIS | Rail and road lines also affected | No | | No | | Indicative | | | | UKE09000002A0001 |

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KEY

- Borough Outline
- Solihull Areas Identified at Risk of Flooding
- Areas Identified as Additional Flood Risk Areas

DRAWING STATUS: FOR INFORMATION


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CLIENT: SOLIHULL METROPOLITAN BOROUGH COUNCIL

ARCHITECT:

PROJECT: SOLIHULL METROPOLITAN BOROUGH COUNCIL PRELIMINARY FLOOD RISK ASSESSMENT

TITLE: INDICATIVE FLOOD RISK AREAS

| SCALE @ A1: | CHECKED: | APPROVED: |
|---|---|---|
| 1:50,000 | AS | OH |
| **CAD FILE:** | **DESIGN-DRAWN:** | **DATE:** |
| IFRA | EJO | MARCH 2011 |
| **PROJECT No:** | **DRAWING No:** | **REV:** |
| 10260095 | PFRA APP C | A |



Drawn By: ukaxp020

File: Q:\WSP_UK\WSP_D\Bristol\Projects\10260095 - Solihul PFRA\Figures\DWG FOR PFRA\IFRA.mxd

# Appendix D Review Checklist

| Preliminary Flood Risk Assessment Checklist | | | | | |
|---|---|---|---|---|---|
| **LLFA Name:** | | | | | |
| | | | | | |
| | **Checklist questions** | **Notes for completion** | **LLFA** | **Environment Agency area review** | **Environment Agency national review** |
| **Step 1** | **Set up governance and develop partnerships** | | | | |
| 1.1 | Have appropriate governance and partnership arrangements been set up? | Refer to section 2.3 of guidance. Governance and partnership arrangements should be to the satisfaction of the LLFA. | Yes | | |
| 1.2 | Who in the LLFA reviewed the PFRA and when was it done? | Please state the review and approval process and when approval was gained e.g. Officer, Scrutiny Committee, Cabinet. Refer to Section 5 of the guidance. | Reviewed prior to submission | | |
| | | | | | |
| **Step 2** | **Determine appropriate data systems** | | | | |
| 2.1 | Has a data management system been established and implemented? | See Annex 5 for information about data standards | Yes | | |
| | | | | | |
| **Step 3** | **Collate information on past and future floods and their consequences** | | | | |
| 3.1 | Has information been requested from all relevant partners? | See Flood Risk Regulations Part 6 Co-operation. | Yes | | |
| 3.2 | Are there any gaps in available information? (This could include gaps which could have been filled but weren't, or gaps which couldn't be filled because the information wasn't available) | LLFAs - Are there gaps in certain locations, or for certain events that you are aware of, or for certain sources of flooding (such as groundwater). Respond with Yes/No and provide comments on any missing information.<br>EA Review - Has all available information has been gathered and included? | There are no known gaps in the data - additional work will be required in areas but all existing data was available | | |
| | | | | | |
| **Step 4** | **Determining locally agreed surface water information** | | | | |
| 4.1 | Which dataset (or combination of datasets) has been determined as "locally agreed surface water information"? | LLFAs - Select from drop down. Refer to "Locally agreed surface water information" text box in section 3.5.1 (p.17) of guidance.<br>EA review - Has this been agreed? | Flood Map for Surface Water | | |
| 4.2 | Has the locally agreed surface water information been clearly stated and presented (on a map) in the Preliminary Assessment Report? | LLFAs - Select Yes/No from drop down list. Refer to "locally agreed surface water information" text box in section 3.5.1 (p.17) of guidance. | Yes | | |
| 4.3 | If available, what is the total property count for locally agreed surface water information in the LLFA? | If known, please enter the total number of properties at risk in the LLFA. | Approximately 7000 | | |
| 4.4 | If applicable, has the method for counting properties been described in the Preliminary Assessment Report? | Refer to text box on page 17 of guidance | Yes | | |
| 4.5 | Has available information on local drainage capacity (where used to inform the determination of locally agreed surface water information) been included in the report? | Refer to text box on page 17 of guidance. Information provided on drainage may inform options for any future improvements to the Flood Map for Surface Water. | Yes | | |

| Preliminary Flood Risk Assessment Checklist | | | | | |
|---|---|---|---|---|---|
| **LLFA Name:** | | | | | |
| | **Checklist questions** | **Notes for completion** | **LLFA** | **Environment Agency area review** | **Environment Agency national review** |
| **Step 5** | **Complete Preliminary Assessment Report Document** | | | | |
| 5.1 | Does the Preliminary Assessment Report cover all the content described in Annex 1 of the Environment Agency's PFRA guidance? | LLFAs - If the Preliminary Assessment Report contains all the content described in Annex 2 of the PFRA guidance, respond with a 'Yes'. If there are some elements missing, please provide a brief explanation.<br>EA Review - Include comments on any missing content. | Yes | | |
| 5.2 | Has a summary table of flood events been produced? | Refer to section 3.4 and 3.5 of guidance | No | | |
| 5.3 | Has a description of past flood events been included? | Refer to section 3.4 and 3.5 of guidance | yes | | |
| 5.4 | Has additional information been included on climate change and long term developments? | Refer to 3.6 of guidance. Standard text has been provided for Preliminary Assessment Reports which meets the minimum requirements of the Flood Risk Regulations. Please respond with Yes or No, and if additional information has been included, please state the information source(s) | yes | | |
| **Step 6** | **Record information on past and future floods with significant consequences in spreadsheet** | | | | |
| 6.1 | Are records of past flooding with significant harmful consequences recorded on the Preliminary Assessment Report spreadsheet (Annex 1 of Prelminary Assessment Report) ? | LLFAs - past flooding should be recorded on the spreadsheet and included as Annex 1 of the Preliminary Assessment Report.<br>EA review - Are all the mandatory fields complete? | N/A | | |
| 6.2 | Are there any past floods with significant harmful consequences that have not been recorded? If so, please explain why not. | LLFAs - Respond with Yes or No. If No, provide additional information e.g. anecdotal information on flood, but not enough evidence to include<br>EA review - Do you agree with LLFA response and comments? | No | | |
| 6.3 | Have any additional records of future flooding (other than the national dataset information which is already completed) been recorded on the future flooding Preliminary Assessment Report spreadsheet (Annex 2 of Preliminary Assessment Report) | LLFAs - future flooding information should be recorded on the spreadsheet and included as Annex 2 of the Preliminary Assessment Report.<br>EA review - Are all mandatory fields complete? | No | | |
| **Step 7** | **Illustrate information on past and future floods** | | | | |
| 7.1 | Have summary maps been produced for past and future floods? | Refer to section 3.4 and 3.5 of guidance | Yes | | |
| **Step 8** | **Review indicative Flood Risk Areas** | | | | |
| 8.1 | Is your LLFA within an indicative Flood Risk Area? | Indicative Flood Risk Areas were provided to LLFAs by the Environment Agency in December 2010. | Yes | | |
| 8.2 | If the answer to 8.1 is yes, have you reviewed it using the locally agreed surface water information, and relevant local information in the Preliminary Assessment Report? | Refer to section 4 of guidance. LLFAs should identify whether they have reviewed against local information or just used the indicative Flood Risk Area information provided by the Environment Agency. | Yes | | |

| Preliminary Flood Risk Assessment Checklist | | | | | |
|---|---|---|---|---|---|
| **LLFA Name:** | | | | | |
| | **Checklist questions** | **Notes for completion** | **LLFA** | **Environment Agency area review** | **Environment Agency national review** |
| **Step 9** | **Identify Flood Risk Areas** | | | | |
| 9.1 | Is a Flood Risk Area proposed? | LLFA - select a response from the drop down list and then complete the relevant questions 9.1.1 - 9.1.5. (NB. Indicative Flood Risk Areas can be amended due to Geography, past flooding and/or future flooding.) | Yes - we have made changes to the indicative Flood Risk Area (respond to relevant questions 9.1.2 - 9.1.4) | | |
| 9.1.1 | If the proposed Flood Risk Area is exactly the same as the indicative Flood Risk Area, please confirm. | LLFA - please confirm that the boundary of the indicative Flood Risk Area has not been changed and no change has been made to the flood risk indicators.<br>EA review - please confirm | N/A | | |
| 9.1.2 | If changes have been made to the indicative Flood Risk Area because of geography, please identify what changes have been made. | Use the drop down list to identify the reasons for the change. Options are the same as the table on page 26 of the PFRA guidance.<br>EA review - please confirm evidence supports change | Minor change in boundary | | |
| 9.1.3 | If changes have been made to the indicative Flood Risk Area because of past / historic flooding, please indicate the changes and the reasons why. | LLFA - identify the scale of the changes made e.g. major/minor increase or decrease in size of Flood Risk Area and the source of information used e.g. records of historic flooding.<br>EA review - confirm scale of the changes made and provide indication of confidence in the evidence provided e.g. anecdotal evidence versus detailed report on flooding event. | Historical flooding on the nationally significant infrastrucre of Birimingham Airport, the A45 and the NEC | | |
| 9.1.4 | If changes have been made to the indicative Flood Risk Areas because of future flooding, please indicate the changes and the reasons why. | LLFA - identify the scale of the changes made e.g. major/minor increase or decrease in size of Flood Risk Area and the source of information used e.g. detailed modelling as part of SWMP.<br>EA review - confirm scale of the changes made and indication of confidence in the evidence | The Indicative flood risk area has been extended to cover the nationally significant infrastructure along the A45 and the M42 | | |
| 9.1.5 | If a new Flood Risk Area is being proposed, does it meet the Defra / WAG thresholds? | Criteria and thresholds are set out in the Defra/WAG guidance on selecting and reviewing Flood Risk Areas for local sources of flooding<br>EA review - identify the evidence provided to support this and indicate degree of confidence in the evidence. | Yes | | |
| 9.2 | Does the proposed Flood Risk Area include flooding from interactions with main river, reservoirs or the sea? | LLFAs should respond with Yes or No.<br>EA Review - Summarise the location and nature of interactions i.e. river or sea. | No | | |
| 9.3 | Has an indicative Flood Risk Area been deleted? | LLFA - Respond with Yes/No and if an indicative Flood Risk Area has been deleted please provide a short description why.<br>EA - confirm the evidence presented to support this is aligned to 'locally agreed surface water information' | No | | |
| **Step 10** | **Record information including rationale - ONLY COMPLETE IF ANSWER TO 9.1 IS YES** | | | | |
| 10.1 | If proposing Flood Risk Areas, have the mandatory fields in the spreadsheet been completed? | LLFAs - the spreadsheet indicates mandatory columns to be completed.<br>EA Review - Are all mandatory fields complete? | Yes | | |
| 10.2 | Has a rationale and evidence for amending/adding/deleting Flood Risk Areas been included in the Preliminary Assessment Report? | LLFAs - Refer to Table 5 on page 26 of the PFRA guidance and Annexes A-D of the Defra/WAG Guidance. Rationale should be included in "Identification of Flood Risk Areas" section of Preliminary Assessment Report.<br>EA Review - Confirm that supporting evidence for any amendments/additions/deletions has been provided in the Preliminary Assessment Report and annexes | N/A | | |

# Appendix E GIS Layer of Flood Risk Areas