**Revision Schedule**

**Black Country Water Cycle Study and Surface Water Management Plan Final Report**
September 2009

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<td>Gemma Costin, Assistant Water Specialist</td>
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Executive Summary

Study Purpose

Scott Wilson were commissioned by the four Black Country Local Authorities, of Dudley, Sandwell, Walsall and Wolverhampton (the Black Country Authorities), to undertake a combined Phase I Water Cycle Study (WCS) and Scoping Level Surface Water Management Plan (SWMP).

The WCS and SWMP will provide an important input into the Black Country Joint Core Strategy, and will inform the sub-regional strategic planning by providing evidence that environmental capacity will not be breached, and the necessary infrastructure is identified and planned for in the optimal way.

The Joint Core Strategy Preferred Options Report (2008) shows that 23,505 houses have been built, or are committed as of 2007, leaving a net housing requirement of 37,695 from 2007 to 2026. Studies indicate a total net capacity of 39,530 (i.e. a surplus of 1,835), of which Dudley can accommodate 28%, Sandwell 36%, Walsall 15% and Wolverhampton 21%.

The Outline Black Country WCS has identified the existing capacity of the water environment and water cycle infrastructure and has used this assessment to determine impacts as a result of development to 2026, and where new infrastructure is required.

Outline WCS

Water Resources and Supply

The Black Country has been assessed as an area of moderate water stress. The Black Country is served by two water companies, Severn Trent Water (ST) and South Staffordshire Water (SSW). The parts of the Black Country lying within ST’s Severn WRZ (3) are the areas around Wolverhampton and also southwest corner of the Black Country around Stourbridge and Halesowen. SSW provides water only services for the four population centres of Dudley, Wolverhampton, Sandwell and Walsall.

ST’s draft WRMP indicates a supply/demand shortfall within the Severn WRZ (3) over the entire planning period through to 2035. Their final WRMP to be published shortly (subject to DEFRA’s approval) indicates a worsening position in terms of deficits once the latest effects of climate change are included. As a result, ST is now proposing resources schemes (mainly groundwater) and demand management measures within WRZ 3.

SSW has sufficient resources to meet the forecast growth in demand plus target headroom for both the annual average and peak week conditions throughout the plan period to 2035. Demand management measures are therefore all that is required by SSW.

An initial assessment of the potential benefits from adopting a Water Neutral position (i.e. no net increase in water demand with new development considered) on all future residential development within the Black Country indicates an achievable target for the Black Country
Authorities to aim for. This would require the 332,000 currently unmetered households to reduce their water consumption to rates just above the level required to meet the CSH Standard Level 1/2 (i.e. around 120 l/h d\(^{-1}\)). Achieving close to water neutrality would reduce the reliance on new water resources being required.

**Wastewater Treatment and Collection**

There are six WwTWs located within the study area and a further eight bordering the area. Eight of these works have been identified as potentially being impacted by proposed development within the study area.

All WwTWs (where information was available to undertake the assessment) have sizeable spare volumetric capacity to treat flows from new development in the area. However, no detailed information on trade flow was provided and therefore the assumptions that have been made as part of this assessment will need to be revisited in any future Detailed WCS.

WwTW quality consents are likely to require tightening under the WFD and as a result of the proposed growth within the area to comply with WFD standards. This should be studied in more detail.

The wastewater network assessment showed that there is a good coverage of existing strategic sewers across the study area which will facilitate new connections to the existing network. However, detailed modelling will need to be undertaken to assess the capacity in the network especially in areas where more than one regeneration corridor will feed into the same sewer (Ray Hill and Roundhill), or the area does not currently have an existing strategic network but significant growth is planned (Brierley Hill).

**Water Environment**

Water quality within the Black Country was assessed downstream of the eight WwTWs as these watercourses are most likely to be impacted by proposed growth within the study area. The water quality has been assessed against current water quality objectives and future WFD targets.

In general, water quality within the Black Country area is of fairly poor quality but has complied with current water quality standards over the latest Environment Agency reporting periods.

None of the watercourses are currently achieving ‘good ecological status’ or ‘good ecological potential’ under the WFD, with biology and phosphate frequently being assessed as poor or bad. Any improvement in the water environment of the Black Country will be achieved by a combination of measures, and investment to improve quality WwTW needs to be considered in context.

Water Cycle Studies should also be compliant with the requirements of the Conservation (Natural Habitats &c) Regulations 1994 (as amended 2007), which interprets the EU Habitats Directive into English & Welsh law. Development may lead to impacts on the Humber SAC and Severn Estuary SPA & RAMSAR site.
Flood Risk

The aim of identifying the potential sources of flood risk to the study areas is to assess the risks of all forms of flooding to and from development, in order to identify any potential development constraints with respect to flood risk. Various documents were reviewed to assess the overall flood risk to the study area. These included the Black Country Level 1 Strategic Flood Risk Assessment (SFRA) and the Wolverhampton Level 2 Strategic Flood Risk Assessment.

The Black Country SFRA stated that the risk of fluvial flooding was relatively low across the sub-region as the number of open watercourses was limited. The main rivers and watercourses posing a fluvial flood risk include the River Tame, River Stour; Ford Brook, Smestow Brook; and Illey Brook.

Given the heavily urbanised nature of the study areas and the steep sided valleys, surface water flood risk remains a significant issue to the sub-region. In addition, the high number of culverted watercourses in urban areas presents a significant residual risk of flooding through culvert blockage and collapse.

Scoping SWMP Executive Summary

Establish Partnerships and Share Data

The heavily urbanised nature of the Black Country and its corresponding high level of impermeable surfaces, the extensive network of culverted rivers, and steep sided valleys, result in a high susceptibility to localised surface water flooding during periods of intense rainfall.

The challenges of managing flood risk in the Black Country is exacerbated by the fragmentation of responsibilities in the management of urban drainage assets which generates inefficiencies following road flooding incidents and it is often not clear which asset failed (trash screen, gully pot, the connection pipe or trunk sewer) or a combination of multiple asset failures.

Based on the management challenges described above, a flood risk stakeholder engagement and communication strategy is needed as part of the next phase of the Black Country SWMP. The inclusion of stakeholder engagement and communications strategy will be critical to the successful delivery of a co-ordinated investment plan.

Given the extensive British Waterways (BW) canal network in the Black Country and the history of flood incidents (canal overtopping into adjacent rivers and surface water flooding through leakages), it is recommended that the Black Country Authorities project team is expanded to include BW as a formal partner in future stages of the SWMP.

Preliminary Risk Assessment - Multiple and Interlinked Sources of Flooding

Given the ambitious targets for growth assigned to the Black Country by the West Midlands RSS and the steer given by Government and the Environment Agency (Defra's Making Space for Water and Technical Guidance on SWMPs, the Pitt Review and the Draft Floods and Water Management Bill), surface water modelling for the entire Black Country area (or on an individual Council basis) should be undertaken to improve the shared understanding of surface water flood risk.
Based upon the fact that this study is a scoping study, no pluvial modelling was undertaken. However, pluvial modelling will be a central element to the next phase of the Surface Water Management Plan risk assessment process - which can be used by Councils in the Black Country to:

- Develop measures and recommendations to manage the sources and pathways of flooding including land management to help tailor the allocations process,
- Prepare for emergencies (together with others in Local Resilience Forums),
- Inform Council Highways drainage and ordinary watercourse investments.

**Groundwater Flooding and SUDS in the Black Country**

Groundwater flooding is an issue in the Black Country partially as a result of the closure of certain types of industry and the cessation of groundwater abstraction for these industries (the primary Boroughs at risk based upon our initial data collection are Sandwell and Wolverhampton). Currently very little is known on past groundwater flooding incidents and the extent and mechanism of groundwater flooding can be difficult to diagnose.

Groundwater flooding is linked to areas with shallow groundwater tables. These areas are typically not suitable for SUDS. Further groundwater investigations are needed throughout the study area to better assess the suitability of infiltration techniques.

In conjunction with more detailed assessments of the mechanisms of groundwater flooding, land contamination needs to be systematically investigated to determine whether SUDS are suitable, as this may restrict the range of available drainage options within the Black Country.

As part of the next phase of a future SWMP, areas at risk of groundwater flooding should be mapped.

**Asset Management**

Given the number of Council owned flood risk assets within the Black Country (approx. 105km of culverts and 131 trash screens plus many other informal defences, concrete structures and embankments) a relatively simple tool – such as a Drainage Asset Register would be the first step towards a integrated understanding of the entire drainage network. We recommend that the development of a Drainage Asset Register would help with the improved understanding of asset ownership, condition and performance.

**Spatial Planning - Strategies for New Development**

Based upon our initial data collection and interviews with the various Local Planning Authorities Drainage Engineers, it appears that there may have been missed opportunities in the past to maximise on the use of SUDS and to shape the final drainage layouts of proposed new developments. An integrated drainage strategy and a checklist for all new developments would ensure a greater use of SUDS, where appropriate as well as providing a satisfactory planning consultation with the Council’s Drainage Engineers.
The lack of a defined river corridor including appropriate buffers for development has resulted in extensive culverting (approximately 105 km) along the river network. This legacy of assets (culverts and trash screens) is expensive to maintain and often contributes to increased flood risk, and potential flood impacts through any blockages. We recommend stronger adaptation to the principles of Making Space for Water (Defra 2005) through the creation of a detailed River Corridor Improvement Plan (RCIP).
## Acronyms and Abbreviations

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<td>Asset Management Plan</td>
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<tr>
<td>BAT</td>
<td>Best Available Technology</td>
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<td>BATNEEC</td>
<td>Best Available Technology Not Entailing Excessive Cost</td>
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<td>EP</td>
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<td>FtFT</td>
<td>Flow to Full Treatment</td>
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<td>HMWB</td>
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<td>Lc&lt;sup&gt;-1&lt;/sup&gt;d&lt;sup&gt;-1&lt;/sup&gt;</td>
<td>Litres per capita per day (water consumption measurement)</td>
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<td>Mld&lt;sup&gt;-1&lt;/sup&gt;</td>
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1 Introduction

Scott Wilson were commissioned by the four Black Country Local Authorities, of Dudley, Sandwell, Walsall and Wolverhampton (The Black Country Authorities), to undertake a combined Phase I Water Cycle Study (WCS) and Scoping Level Surface Water Management Plan (SWMP).

The WCS and SWMP will provide an important input into the Black Country Joint Core Strategy, and will inform the sub-regional strategic planning by providing evidence that environmental capacity will not be breached, and the necessary infrastructure is identified and planned for in the optimal way.

1.1 Growth in the Black Country

The West Midlands Regional Spatial Strategy (WMRSS) (formerly RPG 11) was initially published by Office of the Deputy Prime Minister in June 2004. At that time, the Secretary of State indicated that a fundamental review of the strategy was not necessary in the short term, and that matters needing to be developed further could be undertaken as subsequent revisions. There are three revisions intended to support the existing WMRSS, The Phase One Revision, in respect of the Black Country sub-region, was incorporated into the current WMRSS, which was adopted in January 2008.

At the local level, the Black Country Joint Core Strategy (JCS) - Preferred Options has identified an allocation of 63,035 homes up to 2026, exceeding the targets projections in 2004 by 9,200 dwellings. This target is inline with the conclusions within the Nathantiel Lichfield Partnership (NLP) report and is unlikely to meet any challenge at the Examination in public (EIP).

The Regional Spatial Strategies (RSS) are intended to guide the preparation of local authority Local Development Frameworks and Local Transport Plans, over the period up to 2021 and beyond. They provide long term strategies and deals with the broad locations for development and the movement of people within and between these locations. They do not however, deal with site-specific allocations of land or policies; these are addressed at the local level by the Local Development Framework. The WMRSS focuses growth on the restructuring of the four Major Urban Areas (MUAs) of the Region. These include Birmingham and Solihull, the Black Country, Coventry and North Staffordshire conurbation.

The sub-regional spatial strategy for the Black Country seeks to address the range of challenges set out within RSS, and identifies the spatial proposals within which growth can be managed. It focuses land use and transport restructuring on the four strategic centres, and upon the strategic regeneration corridors that offer opportunities for housing and employment development.

The four strategic centres are West Bromwich and Walsall town centres, and Wolverhampton city centre, together with Brierley Hill.

The Regeneration Corridors include those based on existing and future public transport routes, and on the sub-region’s canal network. These corridors will include those connecting the
strategic centres to each other, and the sub-region to Birmingham city centre; others link the network of local centres in the Black Country.

1.2 Water and Development

In the context of Water Cycle Studies (WCSs) the ‘water cycle’ is defined as both the natural & semi-natural water environment (i.e. rivers, wetland ecosystems, aquifers), and water infrastructure (hard engineering focused elements such as: water treatment works, supply pipelines and pumping stations) which are used by human activity to manipulate the cycle.

In directly manipulating elements of the water cycle, man can impact the natural and semi-natural water environment, and these can be negative, positive or neutral. If growth and development are to be facilitated, there is a requirement for clean water supply, abstracted from various waterbodies, but ultimately taken from natural sources; the treatment of waste water which has to be returned to ground or surface water; and the management of surface water flow paths, which can affect ground and surface water, ecological sites, water quality and flood risk.

In many parts of the UK, some elements of the water environment are considered to be at, or close to, their limit in terms of how much more they can be manipulated.

A WCS will ensure that the sustainability of new development is considered with respect to water, limits are identified, and any new water infrastructure required to facilitate growth is planned in a strategic manner. In so doing, the WCS can ensure that provision of water infrastructure is sufficient such that it reduces negative impacts on the water environment.

1.3 Black Country Water Cycle Study and Surface Water Management Plan and the Planning Process

As part of the LDF process, Local Planning Authorities (LPAs) are required to produce evidence based studies which support the selection processes used in deciding on final growth targets and areas to be promoted for growth. The WCS and Surface Water Management Plan are such examples of evidence based studies which specifically address the impact of proposed growth on the water environment and, as such, will form an important component of the Black Country’s emerging LDFs. Specifically, the Black Country WCS will sit alongside the Sustainability Appraisal, Strategic Environmental Assessment, Appropriate Assessment and Strategic Flood Risk Assessment, and will inform the emerging Black Country Core Strategy Development Plan Document, a key element of the four authorities’ LDFs.

Water Cycle Studies are a relatively new approach to assessing the impact of new development with respect to water. The Black Country WCS and SWMP must be sufficiently robust such that it can form part of the evidence base for Black Country’s emerging LDF.

Section 3.2.3.1 provides more detail on the LDF planning process within the Black Country and other LDF studies that have been or are being produced on behalf of the four Black Country Authorities to act as evidence bases for each developing LDF.
1.3.1 Where does a SWMP sit?

Determining where and how to apply a SWMP within the context of a LPA governance structure is central to the overall success of these plans. Also, given that SWMPs are a relatively new tool, Figure 1.1 is intended to clarify where a SWMP sits highlighting the necessary cross-sector interface and co-ordination needed for successful implementation.

![Diagram of SWMP with cross-sector interface and co-ordination](image)

**Figure 1.1 Necessary Cross-Sector Interface & Co-ordination for Successful SWMP Implementation**

Furthermore, there are three key recommendations from Sir Michael Pitt's independent review into the summer 2007 floods¹ related to Local Authorities, as follows:

**Recommendation 14:** Local Authorities should lead on the management of local flood risk (including surface water flooding) at the local level with the support of relevant organisations.

**Recommendation 16:** Local Authorities should collate and map the main flood risk management and drainage assets (over and underground), including a record of their ownership and condition.

**Recommendation 18:** Local SWMPs, as set out under PPS25 and coordinated by local authorities, should provide the basis for managing all local flood risk.

1.4 Aims and Objectives

The objective of the Black Country WCS (BCWCS) and SWMP Scoping Study are to identify any constraints on housing and employment growth planned for the Borough of Black Country up to 2026 that may be caused by water and how these can be resolved i.e. by assessing the level of appropriate water infrastructure which should be provided to support the proposed development. Furthermore, it will provide a strategic approach to the management and use of water to ensure that the sustainability of the water environment in the region is not compromised.

In conjunction with other strategic studies which inform the LDF, a WCS for Black Country is therefore required to:

- Ensure a co-ordinated approach to identify water supply and waste water infrastructure to support development,
- Avoid negative impact on water-dependent European sites, and non-European designated sites of nature conservation,
- Provide an evidence base for Local Development Documents to site development so that the Black Country Authorities can,
  - Ensure delivery of new development within Black Country in the most sustainable way with respect to the water environment,
  - Maximise potential of existing water infrastructure,
  - Minimise the need for new infrastructure.

This report summarises the outputs of the Outline Water Cycle Study and scoping Surface Water Management Plan. The study has been undertaken following discussions with, and using data provided by, the following key stakeholders:

- Sandwell Metropolitan Borough Council (SMBC),
- Dudley Metropolitan Borough Council (DMBC),
- Wolverhampton City Council (WCC),
- Walsall Borough Council (WBC),
- Environment Agency (EA),
- Severn Trent Water (ST),
- South Staffordshire Water (SSW),
- Natural England (NE).
2 Black Country WCS and SWMP

2.1 The Water Cycle

The human influence on water processes introduces many factors; the need to abstract water for potable and other uses; treat, store and distribute it; and to collect, treat and dispose of wastewater, as shown in Figure 2.1. There is a concomitant need to manage both quantity and quality of surface and groundwater. The development and introduction of technology such as pipes, pumps, drains, and chemical treatment processes has meant that human development has been able to manipulate the natural water cycle to support activities in both rural and urban environments, and to facilitate growth and development. Thus, the term ‘Water Cycle’ in this context can be defined as both the natural & semi-natural water related environment (there are few, if any, totally ‘natural’ water systems in the world, rivers, wetland ecosystems, aquifers for example are all impacted and managed to a greater or lesser extent by direct or indirect actions of human society), and the water infrastructure (hard engineering focused elements such as: water treatment works, supply pipelines and pumping stations) which are used by humans to manage the water environment.

Figure 2.1 The Water Cycle Study

2.2 Implications for Development

Man's management of water has potential to impact built and rural environments in direct and indirect ways. To facilitate growth and development, there is a requirement for water abstraction for potable use which is taken from two main sources (groundwater or surface waters, including; rivers, lakes, reservoirs, canals, desalination plants). A significant proportion of surface water can be re-abstracted after it passes through WWTW's. Un-regulated abstractions can adversely affect water levels, both above and below ground, with subsequent impacts on water chemistry, aquatic ecology and water-dependant habitats. Subsequently, waste water must be collected and treated before being returned to the system, the impact of which on receiving waters needs to be carefully controlled. Finally, the alteration and management of surface water flow paths has implications for flood risk, which again must be quantified and managed to protect life and property.

In many parts of the UK, some elements of the natural water cycle are considered to be at, or close to their limit in terms of how much more they can be manipulated. Further development will lead to an increase in demand for water supply and a commensurate increase in the requirement for waste water treatment; in addition, flood risk may increase if development is not planned for in a strategic manner. The sustainability of the water environment is therefore at risk.

A WCS is an ideal method to quantify this problem and to recommend ways to minimise further impact. A WSC aims to ensure that the sustainability of new development is considered with respect to water, and that new water infrastructure introduced to facilitate growth is planned for in a strategic manner; in so doing, the WCS can ensure that provision of water infrastructure is sufficient such that it encourages sustainable water management.

2.3 Stages of a Water Cycle Study

Current guidance on WCSs suggests that they should generally be undertaken in three stages, (dependent on the status of the various Local Development Documents (LDDs), as part of the wider Local Development Framework (LDF), being prepared by LPAs for submission). To coincide with Black Country’s timescales for responses and submissions the WCS is currently being undertaken in two stages: Scoping & outline (combined) and Detailed (if required).

Figure 2.2 illustrates the three stages of the WCS and how they inform planning decisions and documents.
2.3.1 Scoping Water Cycle Study

The scoping study aims to determine the key water related areas where development is likely to either impact on the water environment, or is likely to require significant investment in water infrastructure (i.e. pipes, or treatment) to service new development.

It is a high level assessment that looks at town or area-wide issues and its key purpose is to define whether there are significant constraints that would need further assessment to determine whether they affect either locations of proposed allocation options, or the amount of development that can be provided within an allocation site.

2.3.2 Outline Water Cycle Study

The Outline Study should consider all of the ways in which new development will impact on the water environment or water infrastructure specific to where growth is most likely to be targeted. It covers all aspects of the water cycle, including:

- Flood risk of development areas;
- Potential for development to increase flood risk,
- Water resource capacity,
- Capacity of clean (potable) water treatment works (WTW) and distribution systems,
• Capacity of wastewater collection, and wastewater treatment works (WwTW);
• Physical capacity of receiving waters,
• Chemical capacity of receiving waters to accept additional loads from WwTW discharges;
• Impact on ecologically important sites that are water related and could be impacted by development e.g. wetland sites with nearby abstractions.

The Outline study should provide a LPA with evidence regarding water issues with respect to proposed location(s) of development, to sit alongside other planning considerations such as schools, transport and utilities. Together these factors have a bearing on how, where and when development could be planned. It therefore plays a key role in the development of Site Allocation DPDs, but more crucially the development of the Core Strategy and the strategic policies which accompany it.

Ideally, the Outline study should assess all of the allocation sites being considered for growth by each LPA, including the scenarios for how different numbers of housing and jobs could be provided in each allocation. In so doing, the outline study should:

• Define the baseline condition of water environment and infrastructure and hence establish how much development could be accommodated without significant investment;
• Outline where there are key ‘water’ constraints to further development in each allocation for each scenario;
• Consider outline options for new infrastructure that would be required to facilitate development beyond the defined ‘capacity’; when and where this would be needed e.g. new, or upgraded flood defence works; expansion of WwTW capacity;
• Determine whether any ecologically sensitive sites would be impacted by development and what are the most likely causes of impact;
• Determine whether reductions in water use could be implemented and how effective they might be in reducing any impacts identified; and
• Produce a summary assessment showing which of the development scenarios is least constrained and will have the least impact on the water environment.

At this stage, an outline study is required to inform the Black Country Authorities Joint Core Strategy and help to develop Site Allocations DPDs. As a result, it cannot go into site specific details of exactly what new infrastructure should be provided and when. The detail of new infrastructure requirements can only be decided once firm decisions have been made about the location of allocations and the scale of development proposed within the allocations.

A key aim of the Outline study is to provide LPAs with the evidence base which ensures that water issues have been taken into account when deciding the location and scale of development within an authority’s planning area as part of the development of the Core Strategy.

An Outline WCS should also give water companies an evidence base to support business plans which determine how much they can charge customers to invest in upgrades and the provision new infrastructure required to service proposed development.
It could be that the Outline Study identifies that water cycle issues are not significant, and that new development can be implemented without significant new investment. If this is the case, a detailed study may not be required.

If new infrastructure is required, or an impact to the water environment cannot be ruled out as significant, a detailed water cycle study will need to be undertaken for site specific allocations, or for the authority as a whole.

2.3.3 Detailed Water Cycle Study

A detailed study can vary significantly in its scope and remit. However, its key purpose is to define what specific infrastructure and mitigation is required to facilitate development, once any decisions have been made on environmental constraints and absolute limiting factors. A detailed WCS should use information on the location of allocations, together with the scale and type of development within them. In so doing, the detailed study will identify:

- When new infrastructure or mitigation is required and hence how development can be phased to minimise impact on the environment;
- Opportunities for providing water environment mitigation that works in synergy with development, management of green corridors and open space (e.g. water balancing ponds and protected urban river corridors);
- Who is responsible for providing the infrastructure/mitigation and maintaining it;
- An approximate costs for new infrastructure & mitigation;
- How developers can contribute to the infrastructure and how funding can be managed; and
- A checklist for developers to use in the preparation of planning applications to ensure the requirements of the water cycle study are planned for at the early possible opportunity and to reduce the likelihood of objections to development from the EA, Water Companies and NE.

Depending on the findings of the Outline Study, there could be the potential requirement to undertake projects in order to define exactly what infrastructure or mitigation is required.

A detailed study should be undertaken in conjunction with the development of DPDs such as Area Action Plans and should provide the evidence base to site specific policies in SPDs.

2.4 Stages of a Surface Water Management Plan

It is recommended that in circumstances where the SWMP is undertaken over a broad geographical area such as the Black Country (approximately 36,000 ha spread across four separate Local Authorities), or where the level of existing information or knowledge is minimal (e.g. SFRA does not adequately cover surface water flooding), an initial high level screening or scoping study should be carried out.

This report constitutes a scoping level SWMP as per the Defra Guidance. The content of each stage is described below.
2.4.1 Scoping (Preparation - Stage 1)

Summary - High-level Assessment of Surface Water Flooding, including:

- Build partnerships of key organisations,
- Share data, information & knowledge,
- Where available, utilise the Environment Agency's 'Areas Susceptible to Surface Water Flooding Mapping,'
- Conduct engineering site inspections,
- Identify areas requiring a more detailed assessment,
- Select a suitable approach (including modelling strategy) for the next steps.

2.4.2 Outline (Risk Assessment - Stage 2)

Summary - Develop a joint understanding of surface water flood mechanisms (building on outputs from the Scoping level study), including:

- 2D hydraulic pluvial modelling (focusing on growth areas only),
- Identify Critical Drainage Areas (CDAs),
- Preliminary identification of options,
- Initial appraisal of options,
- Develop a communications plan.

2.4.3 Detailed (Options appraisal - Stage 3 and Implementation/Review – Stage 4)

Summary - A comprehensive assessment of surface water flooding, including:

- Detailed 1D/2D hydraulic modelling (for existing built up areas and new growth sites),
- Clarify responsibilities and co-ordinate investment in drainage systems to manage the risk,
- Identify where a series of small measures can solve wider problems (total catchment solutions),
- Make recommendations to inform water company plans,
- Cost/benefit analysis of Preferred Option(s) in Agreement with Stakeholders,
- Action Plan and/or Co-ordinated investment plan.
2.5 Integration with the Planning System

As part of the Local Development Framework (LDF) process, LPAs are required to produce evidence based studies which support the selection processes used in deciding on final growth targets and areas to be promoted for growth. The WCS is one such example of an evidence based study which specifically addresses the impact of proposed growth on the water environment.

As part of the overall strategy to meet future growth targets set out in the RSS in a sustainable way, the WCS will make up one of a number of strategic studies and plans which will form part of the evidence base supporting the production of Black Country authorities LDFs. Specifically, the WCS will form an important basis of the Black Country Core Strategy making up part of the LDF, as well as providing input to the development of SPDs to assist in ensuring the delivery of water cycle management requirements at the local planning application level.

There are several other studies which have been, or are in the process of being produced on behalf of Black Country authorities to act as evidence bases to the developing LDF. Those most relevant to the WCS are listed below and the WCS has been informed by these studies:

- Black Country Level 1 Strategic Flood Risk Assessment (SFRA); and
- Black Country Joint Core Strategy – Habitats Regulation Assessment (HRA).

2.6 Data Availability

Undertaking a WCS and SWMP requires a large amount of data collection, much of which is reliant on the willingness of third parties to supply in order to allow the study to be progressed. In some cases, the availability of data with respect to water cycle infrastructure and future planning is not available within the time required to undertake the assessment and various assumptions may be needed to enable the study to continue. This study has built on data collated as part of the Scoping Study and requested further detailed information where required. A catalogue of the data collected, identifying the data provider in each case, and further data required to complete the Detailed WCS has been compiled.
3 The Black Country

3.1 Study Area

The Black Country comprises the administrative areas of Dudley Metropolitan Borough Council (DBC), Sandwell Metropolitan Borough Council (SMBC), Walsall Borough Council (WBC) and Wolverhampton City Council (WCC), as shown in Figure 3.1.

It covers an area of approximately 360km$^2$ and is located to the north west of Birmingham in the West Midlands.

Regeneration in the Black Country is a recognised requirement in the Regional Spatial Strategy. The Black Country has a population of almost 1.1m people, living in 462,000 houses and there are approximately 500,000 jobs, historically based on heavy industry as an important facet of its industrial past. Today it retains important economic activity at the centre of national road, rail and canal networks.
The Black Country is a distinctive sub-region at the heart of Britain. Since 1990, the population has fallen by over 20,000 and net outward migration has approached 4,000 people per annum, hence the Black Country Study recognises that this is one of only four sub regions in the UK experiencing population decline. One of the reasons is thought to be a failure to attract sufficient new employment sectors (especially the knowledge based economy), and the proposed Black Country Core Strategy aims to address the reasons for this, while building on the strengths of the traditional regional economy and environment.

3.2 National, Regional and Local Drivers and Policies

3.2.1 National Drivers and Policies

The growth within the Black Country is driven by regional planning policy, but any growth and changes to the environment will need to comply with EU Directives, as enacted by UK legislation and guidance on water as listed in Table 3-1.

<table>
<thead>
<tr>
<th>Directive/Legislation/Guidance</th>
<th>Description</th>
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<tbody>
<tr>
<td>Bathing Waters Directive 76/160/EEC</td>
<td>To protect the health of bathers, and maintain the aesthetic quality of inland and coastal bathing waters. Sets standards for variables, and includes requirements for monitoring and control measures to comply with standards.</td>
</tr>
<tr>
<td>Code for Sustainable Homes</td>
<td>The Code for Sustainable Homes has been introduced to drive a step-change in sustainable home building practice, providing a standard for key elements of design and construction which affect the sustainability of a new home. It will become the single national standard for sustainable homes, used by home designers and builders as a guide to development, and by home-buyers to assist in their choice of home. It will form the basis for future developments of the Building Regulations in relation to carbon emissions from, and energy use in homes, therefore offering greater regulatory certainty to developers.</td>
</tr>
<tr>
<td>Environment Act 1995</td>
<td>Sets out the role and responsibility of the EA.</td>
</tr>
<tr>
<td>Environmental Protection Act, 1990</td>
<td>Integrated Pollution Control (IPC) system for emissions to air, land and water.</td>
</tr>
<tr>
<td>Future Water, February 2008</td>
<td>Sets out the Government’s vision for water in England in 2030. The strategy sets out an integrated approach to the sustainable management of all aspects of the water cycle, from rainfall and drainage, through to treatment and discharge, focusing on practical ways to achieve the vision to ensure sustainable use of water. The aim is to ensure sustainable delivery of water supplies, and help improve the water environment for future generations.</td>
</tr>
<tr>
<td>Making Space for Water,</td>
<td>Outlines the Government strategy for the next 20 years to implement a</td>
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## Directive/Legislation/Guidance and Description

<table>
<thead>
<tr>
<th>Directive/Legislation/Guidance</th>
<th>Description</th>
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<tbody>
<tr>
<td>2004</td>
<td>more holistic approach to managing flood and coastal erosion risks in England. The policy aims to reduce the threat of flooding to people and property, and to deliver the greatest environmental, social and economic benefit.</td>
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</table>

### Planning Policy Statements and Planning Policy Guidance

Planning policy in the UK is set by Planning Policy Statements (PPSs). They explain statutory guidelines and advise local authorities and others on planning policy and operation of the planning system.

PPSs also explain the relationship between planning policies and other policies which have an important bearing on issues of development and land use. These must be taken into account in preparing development plans.

A water cycle study helps to balance the requirements of the various planning policy documents, and ensure that land-use planning and water cycle infrastructure provision is sustainable.

The most relevant PPSs to WCS are:

- PPS1 – Delivering Sustainable Development;
- PPS1 supplement – Planning and Climate Change;
- PPS3 – Housing;
- PPS9 – Biodiversity and Geological Conservation;
- PPS12 – Local Development Frameworks;
- PPS23 – Planning and Pollution Control; and

### The Pollution Prevention and Control Act (PPCA), 1999

Implements the IPPC Directive. Replaces IPC with a Pollution Prevention and Control (PPC) system, which is similar but applies to a wider range of installations.

### Water Act 2003

Implements changes to the water abstraction management system and to regulatory arrangements to make water use more sustainable.

### Water Framework Directive (WFD) 2000/60/EC

The WFD was passed into UK law in 2003. The overall requirement of the directive is that all river basins must achieve “good ecological status” by 2015 unless there are grounds for derogation. The WFD will, for the first time, combine water quantity and water quality issues together. An integrated approach to the management of all freshwater bodies, groundwaters, estuaries and coastal waters at the river basin level will be adopted. It will effectively supersede all water related legislation which drives the existing licensing and consenting framework in the UK. In England and Wales, the EA is the designated competent authority responsible for the implementation of the WFD.

UKTAG³, an advisory body, has proposed water quality, ecology, water abstraction and river flow standards to be adopted in order to

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³ The UKTAG (UK Technical Advisory Group) is a working group of experts drawn from environment and conservation agencies. It was formed to provide technical advice to the UK’s government administrations and its own member agencies. UKTAG also includes representatives from the Republic of Ireland.
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<thead>
<tr>
<th>Directive/Legislation/Guidance</th>
<th>Description</th>
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<tr>
<td>ensure that water bodies in the UK (including groundwater) meet the required status. These are currently in draft form and will not be formalised until the final River Basin Management Plans are finalised in December 2009 (prior to EC sign off. The WCS is required to consider the longer term issues with respect to the water cycle and water environment and as such, an assessment of the impact of the interim WFD standards has been considered.</td>
<td></td>
</tr>
<tr>
<td>Water Resources Act, 1991</td>
<td>Protection of the quantity and quality of water resources and aquatic habitats.</td>
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### 3.2.2 Regional Drivers and Policies

#### Table 3-2 Water Related Policies in West Midlands Regional Spatial Strategy (WMRSS)\(^5\)

<table>
<thead>
<tr>
<th>Policy</th>
<th>Description</th>
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<tr>
<td>Policy WAT2: Water Infrastructure</td>
<td>“The Environment Agency and water companies should work with OFWAT, EERA and the neighbouring regional assemblies, local authorities, delivery agencies and others to ensure timely provision of the appropriate additional infrastructure for water supply and waste water treatment to cater for the levels of development provided through this plan, whilst meeting surface and groundwater quality standards, and avoiding adverse impact on sites of European or international importance for wildlife. A co-ordinated approach to plan making should be developed through a programme of water cycle and river cycle studies to address the issues of water supply, water quality, wastewater treatment and flood risk in receiving water courses relating to development proposed in this RSS. Complementing this approach, Local Development Documents should plan to site new development so as to maximise the potential of existing water/waste water treatment infrastructure and minimise the need for new/improved infrastructure.”</td>
</tr>
<tr>
<td>Policy WAT3: Integrated Water Management</td>
<td>“Local Planning Authorities should work with partners to ensure their plans, policies, programmes and proposals take account of the environmental consequences of river basin management plans, catchment abstraction management strategies, groundwater vulnerability maps, groundwater source protection zone maps, proposals for water abstraction and storage and the need to avoid adverse impacts on sites of European importance for wildlife. The Environment Agency and water industry should work with local authorities and other partners to develop an integrated approach to the management of the water environment.”</td>
</tr>
</tbody>
</table>
| Policy WAT4: Flood Risk Management | Local Development Documents should:  
- “use Strategic Flood Risk Assessments to guide development away from floodplains, other areas at medium or high risk or likely to be at future risk |

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Policy | Description
--- | ---
 | from flooding, and areas where development would increase the risk of flooding elsewhere; • include policies which identify and protect flood plains and land liable to tidal or coastal flooding from development, based on the Environment Agency’s flood maps and Strategic Flood Risk Assessments supplemented by historical and modelled flood risk data, Catchment Flood Management Plans and policies in Shoreline Management Plans and Flood Management Strategies, including ‘managed re-alignment’ where appropriate; • only propose departures from the above principles in exceptional cases where suitable land at lower risk of flooding is not available, the benefits of development outweigh the risks from flooding, and appropriate mitigation measures are incorporated; and • require that sustainable drainage systems are incorporated in all appropriate developments”.

Policy QE9: The Water Environment | “The Core Strategy promotes the use of SuDS as part of all new development proposals and proposes to integrate floodplain areas into the Boroughs green infrastructure network”.

3.2.3 Local Drivers and Policies

3.2.3.1 Local Development Framework

It is essential that the LDDa making up the LDFs are all informed using the findings and advice from a sound evidence base that examines economic, social and environmental needs and constraints. This must include the comprehensive planning, phasing, delivery and management of water, sewerage, flooding and drainage infrastructure, whilst not adversely affecting environmental capacity. A critical element is therefore to consider in greater detail, the risks associated from all forms of flooding and the existing state, limitations and future requirements of the Black Country water cycle system in the context of future growth.

The Black Country Authorities’ LDF will set out the plan for directing development within the area. The choice of where to locate new development, and new waste water sites, will directly impact upon one another. Due to this, the findings of the WCS will be important in future alterations to the LDF – particularly the Core Strategy, Site Specific Allocations and Minerals and Waste DPDs.

3.2.3.2 Water Company Planning

It is important to consider the planning timelines, both for the Black Country Borough Authorities in terms of their LDFs but also ST and SSW in terms of the funding mechanisms for new water supply and water treatment infrastructure.

There are two elements of Water Company planning that are pertinent to the Black Country WCS and specifically, with regard to integration with Spatial Planning timelines for LPAs and Regional Government.
3.2.3.3 Financial and Asset Planning

Water companies currently plan for Asset Management and the financial procurement required for this through the Asset Management Plan (AMP) process which runs in 5 year cycles. The Office of Water Services (OFWAT) is the economic regulator of the water and sewerage industry in England and Wales, and regulates this overall process.

In order to undertake maintenance of its existing assets and to enable the building of new assets (asset investment), water companies seek funding by charging customers according to the level of investment they need to make. The process of determining how much asset investment required is undertaken in conjunction with;

- The EA as the regulator determining investment required to improve the environment;
- The Drinking Water Inspectorate (DWI) who determine where investment is required to improve quality of drinking water; and,
- OFWAT who along with the EA require Water Companies to plan sufficiently to ensure security of supply (of potable water) to customers during dry and normal years.

The outcome is a Business Plan which is produced by each Water Company setting out the required asset investment over the next 5 year period, the justification for it and the price increases required to fund it.

Overall, the determination of how much a Water Company can charge its customers is undertaken by OFWAT. OFWAT will consider the views of the Water Company, the other regulators (EA, DWI) and consumer groups such as the Consumer Council for Water when determining the price limits it will allow a water Company to set in order to enable future asset investment. This process is known as the Price Review (PR) and is undertaken in 5 year cycles. When OFWAT make a determination on a Water Company’s business plan, the price limits are set for the proceeding five year period allowing the water company to raise the funds required to undertake the necessary investment which will also be undertaken in that 5 year planning period (the AMP period).

Both ST and SSW published their draft Business Plan (BP) for Price Review 2009 (PR09) in August 2008. OFWAT have responded to these plans, individually and in collective response published in October/November 2008. Both companies have now submitted their final BPs which will seek funding for asset investment for the 5 year period covering 2010-2015 (known as AMP5). Their final BPs were published in April 2009.

Ideally any new asset (or infrastructure) investment required to meet the requirements of the WCS should be incorporated into the final BPs. The timing of the Black Country WCS will mean that only those infrastructure improvements which have been included in the final BPs will have a chance of being funded during the AMP5 period. In effect, this will mean that the outcome of this Outline Study WCS will be mainly designed to inform the next Price Review, which comes towards the end of AMP5 and which would result in funding not being available until AMP6 running from 2015-2020.
The WCS is therefore essential for several reasons; it allows the discrepancies in the planning timeframes of ST, SSW and the Black Country Councils to be reconciled through strategic planning as well as providing sufficient evidence base for the different Black Country Council’s statutory LDF processes and robust evidence and justification for both ST and SSW’s Strategic Business Plans for investment required in AMP5 (2010-2015) and beyond.

3.2.3.4 Water Resource Planning

Water companies are now required to produce Water Resource Management Plans (WRMP) on a statutory basis covering 25 year planning horizons. WRMPs set out how a water company plans to provide and invest in existing and new water resource schemes (e.g. reservoirs, desalination) to meet increases in demand for potable supply, as a result of new development, population growth and climate change over the next 25 years. When complete, the new statutory WRMPs will be updated in 5 yearly cycles to coincide with the Price Review and AMP process.

Both ST and SSW submitted their draft Water Resources Management Plans (WRMP) to the Environment Agency in April 2008. These plans have been commented on by the Environment Agency in a response published on 11th August 2008. A statement of response to the consultation on the draft WRMP was published by both ST and SSW in February 2009. Both Water Companies have also now submitted its final WRMPs for the next 25 year period (2010-35). The final WRMPs are due to be published at the end of July 2009 (subject to approval by DEFRA). In effect, this will mean that only the findings from the draft WRMPs and the statement of responses have been incorporated into the Black Country Outline WCS. It may therefore be necessary to revisit the water resources aspects presented in this report, to incorporate the findings of the final WRMP as part of the detailed stage of this WCS.

It can therefore be seen that the WCS is crucial to bridging the gap between the LDF timeframe and the Water Company planning timeframe in terms of strategic planning for new water resources to meet development.

3.2.3.5 Additional Information

In addition to the legislation and guidance set out in Table 3-1, Table 3-2 and above, the following studies and reports are relevant to and have been used within the Black Country WCS:

- EA Catchment Abstraction Management Strategies;
- Black Country Infrastructure Deficit Study 2004 – 2021 (April 2006);
- Black Country Habitat Regulations Assessment Final Report (October 2007);
- Sustainability Appraisal of the Black Country Joint Core Strategy Preferred Options Report (March 2008));
3.3 Development of Housing and Employment

The Black Country has a current population of approximately 1,084,000 (2006) with 461,856 houses\(^6\). By 2026 it is predicted that the population within Black Country will be 1,126,500; an increase of 42,500 population (4%) from the 2006 figures. To accommodate this growth the West Midlands RSS sets a total of 61,200 new dwellings, and the JCS preferred option raises this target to 63,035 to 2026.

Currently, the WMRSS incorporates the Phase One Revision, recognising the Black Country sub-region as vital to the growth strategy for the West Midlands Region as a whole. The Black Country Sub-Region includes the local authority areas of Dudley, Sandwell, Walsall and Wolverhampton.

Tables 3.3 to 3.5 are taken directly from the Join Core Strategy Preferred Options Report (2008) and show housing requirements, Preferred Spatial Strategy housing capacity (by Phase) and Preferred Spatial Strategy housing capacity by Authority. The key messages from these data are that 23,505 houses have been built, or are committed as of 2007, leaving a net housing requirement of 37,695 from 2007 to 2026.

Studies indicate a total net capacity of 39,530 (i.e. a surplus of 1,835), of which Dudley can accommodate 28%, Sandwell 36%, Walsall 15% and Wolverhampton 21%. Of the total capacity of 39,530 houses, 93% are planned in regeneration corridors (including West Bromwich Centre). The remainder are planned for Strategic Centres of Dudley, Walsall and Wolverhampton and additional free standing sites. It should be noted that these figures are estimated against underlying forecasts of 6,160 total demolitions between 2006 and 2026.

\(^6\) Emerging Strategy - RSS Preferred Option - September 2007
## Table 3.3  Black Country Net Housing Requirement 2007-26

<table>
<thead>
<tr>
<th></th>
<th>Dudley</th>
<th>Sandwell</th>
<th>Walsall</th>
<th>W'hampton</th>
<th>Black Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>RSS Phase 2 Requirement 2006 – 2026</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>61,200</td>
</tr>
<tr>
<td>(net) Minima</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Completions and Conversions 2006</td>
<td>760</td>
<td>1,126</td>
<td>672</td>
<td>300</td>
<td>2,858</td>
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<tr>
<td>2007 (net)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sites under construction as of April</td>
<td>518</td>
<td>1,208</td>
<td>900</td>
<td>623</td>
<td>3,249</td>
</tr>
<tr>
<td>2007</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sites with Planning Permission as of</td>
<td>2,184</td>
<td>4,118</td>
<td>3,933</td>
<td>4,492</td>
<td>14,727</td>
</tr>
<tr>
<td>April 2007</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UDP / Adopted Development Plan</td>
<td>1,873</td>
<td>1,265</td>
<td>1,308</td>
<td>1,113</td>
<td>5,559</td>
</tr>
<tr>
<td>Document Allocations as of April 2007</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduction to allow for nonimplementation of commitments*</td>
<td>-368</td>
<td>-538</td>
<td>-1,310</td>
<td>-672</td>
<td>-2,888</td>
</tr>
<tr>
<td>Total completed/ committed capacity</td>
<td>4,967</td>
<td>7,179</td>
<td>5,503</td>
<td>5,856</td>
<td>23,505</td>
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<tr>
<td>Remaining net housing requirement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>37,695</td>
</tr>
</tbody>
</table>

* Varies by source and authority
(Source: Preferred Options Report, 2008)
### Table 3.4  Preferred Spatial Strategy - Housing Capacity (2007-26) by Phase

<table>
<thead>
<tr>
<th>Source of capacity</th>
<th>2007-16</th>
<th>2016-26</th>
<th>2007-26</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Regeneration corridors</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RC 2 Stafford Road</td>
<td>450</td>
<td>930</td>
<td>1,380</td>
</tr>
<tr>
<td>RC 3 South of Wolverhampton City Centre</td>
<td>325</td>
<td>650</td>
<td>975</td>
</tr>
<tr>
<td>RC 4 Wolverhampton – Bilston</td>
<td>600</td>
<td>4,000</td>
<td>4,600</td>
</tr>
<tr>
<td>RC 6 Wednesfield/Willenhall/Darlaston</td>
<td>400</td>
<td>2,150</td>
<td>2,550</td>
</tr>
<tr>
<td>RC 7 Bloxwich/Birchills/Bescot</td>
<td>1,120</td>
<td>680</td>
<td>1,800</td>
</tr>
<tr>
<td>RC 8 Hill Top</td>
<td>2,890</td>
<td>3,180</td>
<td>6,070</td>
</tr>
<tr>
<td>RC 9 Tipton/Dudley Port/Brades Village</td>
<td>2,850</td>
<td>3,300</td>
<td>6,150</td>
</tr>
<tr>
<td>RC 10 Pensnett/Kingswinford</td>
<td>150</td>
<td>585</td>
<td>735</td>
</tr>
<tr>
<td>RC 11 Dudley: Brierley Hill - Stourbridge</td>
<td>2,045</td>
<td>3,080</td>
<td>5,125</td>
</tr>
<tr>
<td>RC 12 Oldbury/West Bromwich/Smethwick</td>
<td>1,400</td>
<td>2,270</td>
<td>3,670</td>
</tr>
<tr>
<td>RC 13 Rowley Regis – Jewellery Line</td>
<td>2,485</td>
<td>4,315</td>
<td>6,800</td>
</tr>
<tr>
<td>RC 14 Coombs Wood – Halesowen</td>
<td>100</td>
<td>400</td>
<td>500</td>
</tr>
<tr>
<td>RC 15 Brownhills</td>
<td>100</td>
<td>540</td>
<td>640</td>
</tr>
<tr>
<td>RC 16 Coseley – Tipton – Princes End</td>
<td>830</td>
<td>1,705</td>
<td>2,535</td>
</tr>
<tr>
<td><strong>Regeneration corridor total</strong></td>
<td>13,385</td>
<td>23,615</td>
<td>37,000</td>
</tr>
<tr>
<td>(constrained by 15%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Free-standing employment sites total</strong></td>
<td>1,395</td>
<td>1,395</td>
<td>2,790</td>
</tr>
<tr>
<td>(constrained by 15%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Strategic centres</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SC1: Wolverhampton</td>
<td>400</td>
<td>2,000</td>
<td>2,400</td>
</tr>
<tr>
<td>SC2: Walsall</td>
<td>75</td>
<td>425</td>
<td>500</td>
</tr>
<tr>
<td>SC3: Brierley Hill</td>
<td>1,500</td>
<td>1,500</td>
<td>3,000</td>
</tr>
<tr>
<td><strong>Strategic centre total</strong></td>
<td>1,975</td>
<td>3,925</td>
<td>5,900</td>
</tr>
<tr>
<td><strong>Housing Demolition Sites</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimated Housing Demolitions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2006-26) ¹</td>
<td>-11,425</td>
<td>-14,375</td>
<td>-25,800</td>
</tr>
<tr>
<td>Estimated Capacity of Demolition Sites</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2006-26) ¹</td>
<td>7,725</td>
<td>11,915</td>
<td>19,640</td>
</tr>
<tr>
<td>Estimated net change on Housing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demolition Sites (2006-26) ¹</td>
<td>-3,700</td>
<td>-2,460</td>
<td>-6,160</td>
</tr>
<tr>
<td><strong>Total Net Capacity</strong></td>
<td>13,055</td>
<td>26,475</td>
<td>39,530</td>
</tr>
</tbody>
</table>

(Source: Preferred Options Report, 2008)

---

7 NB – RC 5 is not included as it is employment based
**Table 3.5  Preferred Spatial Strategy - Housing Capacity (2007-26) by Authority**

<table>
<thead>
<tr>
<th>Regeneration corridor total (constrained by 15%)</th>
<th>Dudley</th>
<th>Sandwell</th>
<th>Walsall</th>
<th>W’hampton</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>RC 2 Stafford Road</td>
<td>1,380</td>
<td>1,380</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RC 3 South of Wolverhampton City</td>
<td></td>
<td>975</td>
<td></td>
<td>975</td>
<td></td>
</tr>
<tr>
<td>RC 4 Wolverhampton – Bilston</td>
<td></td>
<td>4,600</td>
<td></td>
<td>4,600</td>
<td></td>
</tr>
<tr>
<td>RC 6 Wednesfield/Willenhall/Darlaston</td>
<td>2,550</td>
<td></td>
<td></td>
<td>2,500</td>
<td></td>
</tr>
<tr>
<td>RC 7 Bloxwich/Birchills/Bescot</td>
<td>1,800</td>
<td></td>
<td></td>
<td>1,800</td>
<td></td>
</tr>
<tr>
<td>RC 8 Hill Top</td>
<td></td>
<td>5,150</td>
<td>920</td>
<td></td>
<td>6,070</td>
</tr>
<tr>
<td>RC 9 Tipton/Dudley Port/Brades Village</td>
<td>6,150</td>
<td></td>
<td></td>
<td></td>
<td>6,150</td>
</tr>
<tr>
<td>RC 10 Pensnett/Kingswinford</td>
<td>5,125</td>
<td></td>
<td></td>
<td>5,125</td>
<td></td>
</tr>
<tr>
<td>RC 11 Dudley:Brierley Hill - Stourbridge</td>
<td></td>
<td>3,670</td>
<td></td>
<td>3,670</td>
<td></td>
</tr>
<tr>
<td>RC 12 Oldbury/West Brom/Smethwick</td>
<td></td>
<td>2,020</td>
<td>4,770</td>
<td></td>
<td>6,790</td>
</tr>
<tr>
<td>RC 13 Rowley Regis – Jewellery Line</td>
<td>500</td>
<td></td>
<td></td>
<td></td>
<td>500</td>
</tr>
<tr>
<td>RC 14 Coombs Wood – Halesowen</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>640</td>
</tr>
<tr>
<td>RC 16 Coseley – Tipton – Princes End</td>
<td>890</td>
<td>1,645</td>
<td></td>
<td></td>
<td>2,535</td>
</tr>
</tbody>
</table>

| Strategic centres                                | 3,000  |         |         | 2,400     | 5,900  |

| Estimated net change on Housing Demolition Sites (2006- 26)¹ | 50     | -4,635  | -1,200  | -375      | -6,160 |
| Total net capacity                                 | 11,160 | 14,310  | 5,860   | 8,200     | 39,530 |
| Completed / committed capacity                      | 4,967  | 7,179   | 5,503   | 5,856     | 23,505 |
| Net Completions (2006-26)                          | 16,127 | 21,489  | 11,363  | 14,056    | 63,035 |
| Estimated Gross Completions (2006-26)              | 22,000 | 34,355  | 15,365  | 17,115    | 88,835 |

(Source: Preferred Options Report, 2008)
Table 3.6  Black Country Regeneration Corridors and Free Standing Employment Sites

<table>
<thead>
<tr>
<th>REGENERATION CORRIDORS</th>
<th>Existing Employment Land (ha)</th>
<th>Housing Commitments on Employment Land (ha)</th>
<th>Remaining Employment Land – existing minus commitments (ha)</th>
<th>Retained High Quality Employment Land (ha)</th>
<th>Potential High Quality Employment Land (ha)</th>
<th>Retained Local Employment Land/Other Uses (ha)</th>
<th>New Housing (gross ha)</th>
<th>Total Dwellings (unconstrained)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RC1: Pendeford / Fordhouses (Wolverhampton)</td>
<td>74</td>
<td>0</td>
<td>74</td>
<td>27</td>
<td>47</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>RC2: Stafford Road (Wolverhampton)</td>
<td>132</td>
<td>18</td>
<td>114</td>
<td>20</td>
<td>47</td>
<td>14</td>
<td>33</td>
<td>1380</td>
</tr>
<tr>
<td>Total</td>
<td>206</td>
<td>18</td>
<td>188</td>
<td>47</td>
<td>94</td>
<td>14</td>
<td>33</td>
<td>1380</td>
</tr>
<tr>
<td>RC3: South of Wolverhampton City Centre (Wolverhampton)</td>
<td>53</td>
<td>0</td>
<td>53</td>
<td>0</td>
<td>0</td>
<td>28</td>
<td>25</td>
<td>975</td>
</tr>
<tr>
<td>RC4: Wolverhampton – Bilston Corridor (Wolverhampton) – Option 1</td>
<td>358</td>
<td>63.5</td>
<td>294</td>
<td>33</td>
<td>16</td>
<td>143</td>
<td>102</td>
<td>4590</td>
</tr>
<tr>
<td>Total</td>
<td>411</td>
<td>63.5</td>
<td>347</td>
<td>33</td>
<td>16</td>
<td>171</td>
<td>127</td>
<td>5565</td>
</tr>
<tr>
<td>RC5: Loxdale – Moxley (Wolverhampton)</td>
<td>58</td>
<td>0</td>
<td>58</td>
<td>0</td>
<td>58</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>RC5: Loxdale – Moxley (Walsall)</td>
<td>25</td>
<td>0</td>
<td>25</td>
<td>0</td>
<td>25</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>RC8: Hill Top (Walsall)</td>
<td>27</td>
<td>4</td>
<td>23</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>23</td>
<td>920</td>
</tr>
<tr>
<td>RC8: Hill Top (Sandwell)</td>
<td>410</td>
<td>13</td>
<td>397</td>
<td>130</td>
<td>120</td>
<td>44</td>
<td>103</td>
<td>5150</td>
</tr>
<tr>
<td>RC9: Tipton – Dudley Port – Brades Village (Sandwell)</td>
<td>261</td>
<td>31</td>
<td>230</td>
<td>0</td>
<td>0</td>
<td>55</td>
<td>175</td>
<td>6150</td>
</tr>
<tr>
<td>RC12: Oldbury – West Bromwich – Smethwick (Sandwell)</td>
<td>550</td>
<td>15</td>
<td>535</td>
<td>65</td>
<td>242</td>
<td>144</td>
<td>84</td>
<td>3670</td>
</tr>
</tbody>
</table>
## Table 3.6  Black Country Regeneration Corridors and Free Standing Employment Sites

<table>
<thead>
<tr>
<th>REGENERATION CORRIDORS</th>
<th>Existing Employment Land (ha)</th>
<th>Housing Commitments on Employment Land (ha)</th>
<th>Remaining Employment Land – existing minus commitments (ha)</th>
<th>Retained High Quality Employment Land (ha)</th>
<th>Potential High Quality Employment Land (ha)</th>
<th>Retained Local Employment Land/Other Uses (ha)</th>
<th>New Housing (gross ha)</th>
<th>Total Dwellings (unconstrained)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RC16: Coseley – Tipton – Princes End (Dudley)</td>
<td>62</td>
<td>0</td>
<td>62</td>
<td>0</td>
<td>0</td>
<td>40</td>
<td>22</td>
<td>890</td>
</tr>
<tr>
<td>RC16: Coseley – Tipton – Princes End (Sandwell)</td>
<td>47</td>
<td>8</td>
<td>47</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>47</td>
<td>1645</td>
</tr>
<tr>
<td>RC4: Wolverhampton – Bilston Corridor (Wolverhampton) – Option 2</td>
<td>358</td>
<td>63.5</td>
<td>294</td>
<td>33</td>
<td>16</td>
<td>143</td>
<td>102</td>
<td>3500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1798</strong></td>
<td><strong>134.5</strong></td>
<td><strong>1671</strong></td>
<td><strong>228</strong></td>
<td><strong>461</strong></td>
<td><strong>426</strong></td>
<td><strong>556</strong></td>
<td><strong>21925</strong></td>
</tr>
<tr>
<td>RC6: Darlaston – Willenhall – Wednesfield (Wolverhampton)</td>
<td>143</td>
<td>0</td>
<td>143</td>
<td>27</td>
<td>116</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>RC6: Darlaston – Willenhall – Wednesfield (Walsall) Option 1</td>
<td>287</td>
<td>10</td>
<td>277</td>
<td>8</td>
<td>111</td>
<td>112</td>
<td>46</td>
<td>2550</td>
</tr>
<tr>
<td>RC6: Darlaston – Willenhall – Wednesfield (Walsall) Option 2</td>
<td>287</td>
<td>10</td>
<td>277</td>
<td>8</td>
<td>111</td>
<td>85</td>
<td>73</td>
<td>2550</td>
</tr>
<tr>
<td>RC7: Bloxwich – Birnchalls – Bescot (Walsall)</td>
<td>231</td>
<td>18</td>
<td>213</td>
<td>6</td>
<td>0</td>
<td>168</td>
<td>39</td>
<td>1800</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>948</strong></td>
<td><strong>38</strong></td>
<td><strong>910</strong></td>
<td><strong>49</strong></td>
<td><strong>338</strong></td>
<td><strong>365</strong></td>
<td><strong>158</strong></td>
<td><strong>6900</strong></td>
</tr>
<tr>
<td>RC10: Pensnett – Kingswinford (Dudley)</td>
<td>157</td>
<td>0</td>
<td>157</td>
<td>0</td>
<td>94</td>
<td>42</td>
<td>21</td>
<td>735</td>
</tr>
<tr>
<td>RC11: Dudley – Brierley Hill – Stourbridge (Dudley)</td>
<td>305</td>
<td>0</td>
<td>305</td>
<td>0</td>
<td>102</td>
<td>76</td>
<td>127</td>
<td>5125</td>
</tr>
</tbody>
</table>
### Table 3.6  Black Country Regeneration Corridors and Free Standing Employment Sites

<table>
<thead>
<tr>
<th></th>
<th>Existing Employment Land (ha)</th>
<th>Housing Commitments on Employment Land (ha)</th>
<th>Remaining Employment Land – existing minus commitments (ha)</th>
<th>Retained High Quality Employment Land (ha)</th>
<th>Potential High Quality Employment Land (ha)</th>
<th>Retained Local Employment Land/Other Uses (ha)</th>
<th>New Housing (gross ha)</th>
<th>Total Dwellings (unconstrained)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>REGENERATION CORRIDORS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RC13: Rowley Regis – Jewellery Line (Sandwell)</td>
<td>155</td>
<td>5</td>
<td>150</td>
<td>0</td>
<td>0</td>
<td>44</td>
<td>106</td>
<td>4770</td>
</tr>
<tr>
<td>RC13: Rowley Regis – Jewellery Line (Dudley)</td>
<td>64</td>
<td>2</td>
<td>62</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>50</td>
<td>2020</td>
</tr>
<tr>
<td>RC14: Coombs Wood – Halesowen (Dudley)</td>
<td>110</td>
<td>0</td>
<td>110</td>
<td>77</td>
<td>0</td>
<td>20</td>
<td>13</td>
<td>500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>791</td>
<td>7</td>
<td>784</td>
<td>77</td>
<td>196</td>
<td>194</td>
<td>317</td>
<td>13150</td>
</tr>
<tr>
<td>F</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RC15: Brownhills (Walsall)</td>
<td>65</td>
<td>0</td>
<td>65</td>
<td>20</td>
<td>0</td>
<td>29</td>
<td>16</td>
<td>640</td>
</tr>
<tr>
<td><strong>FREE STANDING EMPLOYMENT SITES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dudley</td>
<td>33</td>
<td>0</td>
<td>33</td>
<td>0</td>
<td>0</td>
<td>26</td>
<td>7</td>
<td>275</td>
</tr>
<tr>
<td>Sandwell</td>
<td>20</td>
<td>0</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>18</td>
<td>900</td>
</tr>
<tr>
<td>Walsall</td>
<td>221</td>
<td>25</td>
<td>196</td>
<td>8</td>
<td>8</td>
<td>135</td>
<td>45</td>
<td>1800</td>
</tr>
<tr>
<td>Wolverhampton (Option A)</td>
<td>47</td>
<td>0</td>
<td>47</td>
<td>0</td>
<td>0</td>
<td>38</td>
<td>9</td>
<td>315</td>
</tr>
<tr>
<td>Wolverhampton (Option B)</td>
<td>47</td>
<td>0</td>
<td>47</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>39</td>
<td>1350</td>
</tr>
<tr>
<td>All Free Standing (Option A)</td>
<td>321</td>
<td>25</td>
<td>296</td>
<td>8</td>
<td>8</td>
<td>201</td>
<td>79</td>
<td>3290</td>
</tr>
<tr>
<td>All Free Standing (Option B)</td>
<td>321</td>
<td>25</td>
<td>296</td>
<td>8</td>
<td>8</td>
<td>171</td>
<td>109</td>
<td>4325</td>
</tr>
<tr>
<td><strong>Total (Option 1/A)</strong></td>
<td>3867</td>
<td>195.5</td>
<td>3671</td>
<td>421</td>
<td>986</td>
<td>1172</td>
<td>1092</td>
<td>45745</td>
</tr>
<tr>
<td><strong>Total (Option 2/B)</strong></td>
<td>3867</td>
<td>195.5</td>
<td>3671</td>
<td>421</td>
<td>986</td>
<td>1115</td>
<td>1149</td>
<td>45800</td>
</tr>
</tbody>
</table>
4 Water Resources and Water Supply Baseline Assessment

4.1 Introduction

This assessment covers the existing baseline with respect to available water resources and where the raw water to supply the new development may be sourced. It also considers the important role which water efficiency can play in order to reduce the demand for new resources.

There are two water and sewerage undertakers (provider of services) which serve the Black Country. ST provides the water services for Wolverhampton and sewerage services for the bulk of properties within the Black Country. SSW provides water services only for the population centres of Dudley, Sandwell and Walsall.

ST is the second largest water and sewerage company within England and Wales, supplying around 2,000 mega litres per day (Mld) and taking away this amount of wastewater from its 3.3 million customers.

SSW is one of the larger water only providers in England and Wales, supplying around 325 Mld to customer base of 1.3 million.

As both these water companies are monopoly supplier of services in their area, these businesses operate under a regulated environment with the EA, OFWAT (the economic regulator) and the DWI (the Drinking Water Inspectorate) controlling their activities. It is the responsibility of these organisations ensure that both ST and SSW operate as efficient water and sewerage companies, and at the same time that they maintain (or where practical improve) the wider environment in which the Companies operate.

4.2 Available Data

The principal sources of data assessed within this review are as follows:

- ST’s and SSW’s draft Water Resources Management Plan (WRMP) (ST 2008, SSW 2008);
- ST’s (2009) and SSW’s (2009) draft WRMP – Statement of Response to Consultation (ST 2009, SSW 2009);
- EA’s representation on ST’s and SSW’s draft WRMP (EA, 2008c and 2008d);
- the location of the existing sources of raw water supply across the Black Country, including licensed daily abstraction and annual maximum abstraction limits, and approximate locations of storage reservoirs; and
4.3 Regional Water Resources: Existing Situation

The local water resources are replenished by an average annual rainfall (1961-1990) of approximately 754mm falling across the Black Country. This figure compares with an average figure for England and Wales of 895mm (EA/DEFRA 2008f).

Evaporation from vegetation reduces this amount by approximately 450mm a year, to give around 300mm per annum of ‘effective rainfall’ to replenish aquifers and to maintain river flows. The recharge of aquifers is an important mechanism for providing feeds to groundwater-fed ecosystems and wetland habitats. This is aligned with the government policy to maximise Sustainable Urban Drainage Systems (SUDS) where possible and practical (see Section 11.2).

In drought years, such as occurred in 1996, the rainfall across the ST Region can be as low as 600mm, which reduces the amount of ‘effective rainfall’ to around 150mm. The climate gradient from west to east and from north to south is accentuated across the region. The region’s water supply is sourced from two main sources:

- Surface Water Abstraction (rivers and reservoirs) – 60%; and
- Groundwater Abstraction – 40%.

In the case of both ST and SSW, the relative proportions derived from surface water and groundwater is similar to the above figures (see Section 4.4.1).

4.4 The Black Country - Water Resource Baseline Assessment

According to the EA, the Black Country lies within an area of moderate water stress.

The EA manages water resources at the local level through the use of Catchment Abstraction Management Plans (CAMS). The Black Country lies partly within the Worcestershire Middle Severn CAMS (EA, 2006), Severn Corridor CAMS (EA, 2003) and the Tame, Anker and Mease CAMS (EA, 2008).

Within the CAMS, the EA’s assessment of the availability of water resources is based on a classification system that allocates a resource availability status indicating:

- the relative balance between the environmental requirements for water and how much is licensed for abstraction;
- whether water is available for further abstraction; and
- areas where abstraction needs to be reduced.

The categories of resource availability status are shown in Table 4-1. The classification is based on an assessment of a river system’s ecological sensitivity to abstraction-related flow reduction. This classification can then be used to assess the potential for additional water resource abstractions.
Table 4-1: CAMS Resource Availability Status Categories

<table>
<thead>
<tr>
<th>Indicative Resource Availability Status</th>
<th>License Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Available</td>
<td>Water is likely to be available at all flows including low flows. Restrictions may apply.</td>
</tr>
<tr>
<td>No Water Available</td>
<td>No water is available for further licensing at low flows. Water may be available at higher flows with appropriate restrictions.</td>
</tr>
<tr>
<td>Over Licensed</td>
<td>Current actual abstraction is such that no water is available at low flows. If existing licences were used to their full allocation they could cause unacceptable environmental damage at low flows. Water may be available at high flows, with appropriate restrictions.</td>
</tr>
<tr>
<td>Over Abstracted</td>
<td>Existing abstraction is causing unacceptable damage to the environment at low flows. Water may still be available at high flows, with appropriate restrictions.</td>
</tr>
</tbody>
</table>

The classification for each of the catchments within the Black Country are shown in Table 4-2.

Table 4-2: CAMS Resources within the Black Country Catchment Areas

<table>
<thead>
<tr>
<th>WRMU/GWMU Name</th>
<th>Associated Main River</th>
<th>Resource Availability Status</th>
<th>Individual WRMU Status</th>
<th>Integrated WRMU Status</th>
<th>Target Status in 2012/13</th>
<th>Target Status in 2018/19</th>
</tr>
</thead>
<tbody>
<tr>
<td>WRMU1 – Fluvial Trent and tributaries¹</td>
<td>Rivers Trent, Greet &amp; Devon and Diseworth Sherwood Sandstone Group GWMU</td>
<td>Water Available</td>
<td>Water Available</td>
<td>Water Available</td>
<td>Water Available</td>
<td></td>
</tr>
<tr>
<td>WRMU4 - River Worfe to River Stour confluence (AP14)²</td>
<td>Severn</td>
<td>No Water Available</td>
<td>No Water Available</td>
<td>No Water Available</td>
<td>No Water Available</td>
<td></td>
</tr>
<tr>
<td>WRMU2 – Stour, Worfe &amp; Salwarpe³</td>
<td>Stour, Worfe &amp; Salwarpe</td>
<td>Over Abstracted</td>
<td>Over Abstracted</td>
<td>Over Abstracted</td>
<td>Over Abstracted</td>
<td></td>
</tr>
<tr>
<td>GWMU³</td>
<td>Stour, Worfe &amp; Salwarpe</td>
<td>Over Abstracted</td>
<td>Over Abstracted</td>
<td>Over Abstracted</td>
<td>Over Abstracted</td>
<td></td>
</tr>
</tbody>
</table>

Key: Integrated WRMU status in table refers to the availability status after downstream conditions have been taken into account and/or, in the case of groundwater, the status of an overlying river.

¹ Tame, Anker and Mease CAMS
² Severn Corridor CAMS
³ Worcester Middle Severn CAMS

4.4.1 Abstraction Sources

Local water resources are used to supply public drinking water and maintain sufficient water for agriculture, industry and the natural environment. There are both surface water and groundwater resources.
4.4.1.1 Surface Water Abstraction

SSW abstracts water from two surface water sources; Blithfield Reservoir and River Severn. ST also abstracts water from the River Severn. In both cases, about 60% of their water supply is obtained from surface water sources.

The Blithfield Reservoir is an impoundment reservoir with a capacity of approximately 18,224 Ml/d of water. It was formed in 1953 by the construction of a dam across the River Blithe, to the north of the Black Country and River Trent.

The River Severn is the other principal source of surface water, which lies approximately 15km at its closest point from the Black Country’s western boundary. Both SSW and ST abstract water at Hampton Loade on the River Severn to supply South Staffordshire area (SSW) and Wolverhampton (ST).

The surface water abstractions from the River Severn are supported by releases from upland reservoirs, such as Clywedog Reservoir and Lake Vyrnwy (both in mid-Wales). Further discussion of the support provided to the River Severn is included in section 4.4.1.3.

4.4.1.2 Groundwater Abstraction

SSW abstracts from around 60 boreholes in the Sherwood Sandstone Aquifer of the Staffordshire Basin (most of which lies outside the Black Country boundary area). On average there are three boreholes at each groundwater site. The Sherwood Sandstone, which forms a ring around the edge of Black Country has large water storage capacity within the structure of this strata and it does not tend to react rapidly to periods of low rainfall. Therefore, it gives a relatively reliable and constant supply of water. SSW abstracts approximately 40% of its supply from these groundwater sources.

ST also abstracts from groundwater sources, mainly from the Sherwood Sandstone Aquifer within the Staffordshire Basin. In total, there are about 20 sources operated by ST in the Black Country area (information provided by the EA).

In addition to these public water supply abstractions, there also numerous private abstractions from groundwater to support industry, agriculture and private domestic supplies.

4.4.1.3 Shropshire Groundwater Scheme

Groundwater is also used by the EA to support abstractions from the River Severn. This scheme known as the Shropshire Groundwater Scheme involves abstracting from the Sandstone aquifer which lies to the north of Telford and using this water to support both the River Tern and River Severn. The system has huge potential to support these rivers in the future, although only a small part of this resource is used at the present time. The EA, who operate this Groundwater Scheme, have undertaken a number of studies in recent years to look at the effects on environmentally sensitive habitats, the reduction in the availability of soil moisture to agricultural crops and trees.
4.5 Water Supply - Existing Capacity

The Black Country lies within the operational areas of both ST and SSW. ST provides supplies to Wolverhampton in the northwest corner of the Black Country and parts of the southwest corner around Stourbridge and Halesowen. These areas all lie within ST’s Severn (WRZ 3). SSW provides water supplies to the population centres of Dudley, Sandwell and Walsall.

SSW’s supply system (see Figure 4.1) – raw water is taken out of the Blithfield Reservoir and fed through a pipeline to the Water Treatment Works (WTW) at Seedy Mill near Lichfield (just outside the northeast boundary of the Black Country), before going into the distribution network around Walsall. Raw water taken from the River Severn at Hampton Loade, is stored in the Chelmarsh Reservoir (a bank-side storage reservoir situated in Shropshire) before being treated and distributed into network around Wolverhampton, Dudley and Sandwell. In general, the groundwater fed WTWs are generally smaller, as the amount of water treatment required for groundwater is generally less than for surface water, and are more widely distributed around the area of Sherwood Sandstone outcrop.

Figure 4.1: South Staffordshire Water Supply Area and Black Country Study Area

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SSW, 2008
ST’s Supply system is again a mixture of surface water (from the River Severn) and groundwater (from the Sherwood Sandstone Aquifer). ST’s abstraction at Hampton Loade and Trimley/Strensham on the River Severn provides supplies for their WRZ3 – Severn (shown in green in Figure 4.2).

Figure 4.2: Location of Water Resource Zones around the Black Country

4.5.1 Water Resource Management Plans – ST and SSW

As part of a water company’s business planning process (AMP), each water company is required to prepare a plan showing how the growth in demand over the next 25 years will be met. Both ST and SSW prepared a draft WRMP in April 2008. Updates to these plans have now been produced in a Statement of Response to the consultation on the draft WRMP, and following the EA’s response to the draft plans published in July 2008. The updates were published by both ST and SSW in March 2009 and these are likely to closely match the final WRMP which are due to be published shortly (subject to approval by Defra).

4.5.1.1 Severn Trent Water’s WRMP

ST’s draft WRMP indicates a supply/demand shortfall within the Severn WRZ (3) over the entire planning period through to 2035. In the latest update (March 2009), the impacts of climate change on deployable output gives more severe results (i.e. greater shortfalls) than in the draft WRMP. Although there has been some reduction in the demand, brought about the recent down-turn, the overall net effect of these changes in the projected supply/demand shortfall is around 120 Mld\(^{-1}\). As a result, ST is now proposing resources schemes (mainly groundwater) and demand management measures within this WRZ. The precise timing of these schemes will be included in the final WRMP.
The situation with regards to water resources has been confirmed in an e-mail sent by Steve Southern (ST) on 30th March 2009.

The parts of the Black Country lying within the Severn WRZ are the areas around Wolverhampton and also southwest corner of the Black Country around Stourbridge and Halesowen.

4.5.1.2 South Staffordshire Water’s WRMP

The latest SSW draft WRMP shows only modest changes to various components of the supply/demand balance. Overall, the Company has sufficient resources to meet the forecast growth in demand plus target headroom\(^{10}\) for both the annual average and peak week conditions throughout the plan period to 2035. The surplus of resources means that there is no requirement for either supply-side or demand side interventions other than those included in the draft WRMP (mainly demand management measure – see Section 4.5.3).

This healthy situation means that those parts of Black Country supplied by SSW i.e. Walsall, Dudley and Sandwell should all have sufficient resources to meet the planned growth for these areas.

4.5.2 Forecast Growth in Demands

In general, ST and SSW have both assumed the growth contained within the RSSs, in this case the West Midlands RSS, as the basis for forecasting the growth in their areas. The Black Country Preferred Options Report contains growth figures which are slightly above those contained within the WMRSS and these have been used in this study. The sections below contain estimates of both the residential and non-residential demands forecast for the Black Country.

It should be noted that following the Preferred Options Report, and since the analysis of growth figures in this report was carried out, the Publication Core Strategy growth figures are now the same as those in the WMRSS. As a result, the development growth figures tested in the WCS and SWMP are slightly higher, however, this should have a negligible impact on the results.

4.5.2.1 Residential Demands

The estimates in growth from residential demand for the different parts of Black Country are included in Table 4-3.

To calculate these demands, it is necessary to multiply the number of new homes by the average occupancy rate (OR) and by the average water use per person. In the case of the Black Country, then the two Water Companies, ST and SSW have slightly different metered water uses, although the OR for both companies is similar at 2.3. The average water consumption rates figures used are 115 litres/head/day (lh\(^{-1}\)d\(^{-1}\)) in the case of ST customers, and 127 lh\(^{-1}\)d\(^{-1}\) for SSW customers.

In addition to the water company forecast (Scenario 1), three other scenarios have been included based on the Code for Sustainable Homes (CSH), which provides a system of

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\(^{10}\) Headroom is the minimum buffer that a prudent water company should add to demand to cater for specified uncertainties, such as the under-estimating certain parameters, as well as taking account of the uncertainties from climate change.
credits for all new buildings depending on their level of water efficiency of 120, 105 and 80 lh\(^{-1}\)d\(^{-1}\) – Scenarios 2, 3 and 4 respectively.

Table 4-3 shows that for the water company forecast (Scenario 1), the total residential water demand for the Black Country up to 2026 would be 18 Mld\(^{-1}\). Broken down into the individual population centres, then the demands are highest in the Sandwell area (6.3 Mld\(^{-1}\)) and lowest in the Walsall area (3.3 Mld\(^{-1}\)), although the Wolverhampton area (3.7 Mld\(^{-1}\)) is broadly similar. It should be remembered that Wolverhampton, which lies within ST’s Severn WRZ, has sizeable supply/demand shortfalls (see Section 4.5.1.1).

Using the CSH estimates of water consumption, the total residential water demands would vary from 11.6 Mld\(^{-1}\) (Scenario 4 – CSH Level 5/6, 80 lh\(^{-1}\)d\(^{-1}\)) to 17.4 Mld\(^{-1}\) (Scenario 2 – CSH Level 1/2, 120 lh\(^{-1}\)d\(^{-1}\)) by 2026.
## Table 4-3: Residential Water Demands in the Black Country

<table>
<thead>
<tr>
<th>Development Areas</th>
<th>Nos. dwellings (JCS Preferred Option)</th>
<th>Water Company Forecast</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>Scenario 3</th>
<th>Scenario 4</th>
<th>Scenario 4</th>
<th>Scenario 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Code for Sustainable Homes Rating 1/2 120 lh(^{-1}) d(^{-1})</td>
<td>Code for Sustainable Homes Rating 3/4 105 lh(^{-1}) d(^{-1})</td>
<td>Code for Sustainable Homes Rating 5/6 80 lh(^{-1}) d(^{-1})</td>
<td>Range of Estimates Min (Col 8)</td>
<td>Range of Estimates Max (Col 5)</td>
<td></td>
</tr>
<tr>
<td>Wolverhampton</td>
<td>ST</td>
<td>14,056</td>
<td>3.72</td>
<td>3.88</td>
<td>3.39</td>
<td>2.59</td>
<td>2.59</td>
<td>3.72</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walsall</td>
<td>SSW</td>
<td>11,363</td>
<td>3.32</td>
<td>3.14</td>
<td>2.74</td>
<td>2.09</td>
<td>2.09</td>
<td>3.32</td>
</tr>
<tr>
<td>Dudley</td>
<td>SSW</td>
<td>16,127</td>
<td>4.71</td>
<td>4.45</td>
<td>3.89</td>
<td>2.97</td>
<td>2.97</td>
<td>4.71</td>
</tr>
<tr>
<td>Sandwell</td>
<td>SSW</td>
<td>21489</td>
<td>6.28</td>
<td>5.93</td>
<td>5.19</td>
<td>3.95</td>
<td>3.95</td>
<td>6.28</td>
</tr>
<tr>
<td>Black Country Total</td>
<td></td>
<td>63,035</td>
<td>18.02</td>
<td>17.40</td>
<td>15.22</td>
<td>11.60</td>
<td>11.60</td>
<td>18.02</td>
</tr>
</tbody>
</table>

*1 Assuming 115 lh/d supplied for ST areas and 127 lh/d for SSW areas. In both cases occupancy rate of 2.3 assumed (OFWAT 2007-08)

*2 Code for Sustainable Homes - Water consumption targets for Code 1/2 homes and an assuming occupancy rate of 2.3 (OFWAT 2007-08)

*3 Code for Sustainable Homes - Water consumption targets for Code 3/4 homes

*4 Code for Sustainable Homes - Water consumption targets for Code 5/6 homes
4.5.2.2 Non-Residential Demands

In addition to the increased residential demand, the JCS also refers to growth in employment (jobs) within the Black Country. Limited information is available on the location and type of employment to be created and therefore any estimates of non-residential demand should be considered provisional at this stage.

The UK Water Industry has traditionally used complex econometric forecasting models to assess what may happen to the demands from industry in the future. For the Black Country WCS, Scott Wilson has based its estimates of non-residential demand on the relationship which exists between non-residential and residential water demands as reported by OFWAT. In the case of ST, the non-residential metered demand is around 58% of the residential metered demand, while for SSW it is 66%. A pragmatic figure of 60% has been used for these calculations. Assuming the Black Country to be similar to the wider areas served by ST and SSW, then the non-residential demand will be approximately 6/10th of the residential demand.

Based on these assumptions, Table 4-4 shows the total non-residential demand for the Black Country up to 2026 would be 10.8 Mld\(^{-1}\) (Scenario 1, water company forecast). Apportionment of this amount into the individual population centres would indicate that largest growth in the non-residential demand would come from the Sandwell area (4.18 Ml/d), whilst the growth the other three areas is roughly similar at between 2.1 and 2.3 Ml/d.

4.5.2.3 Total Water Demands

Table 4-5 shows the combined residential and non-residential demand figures for the Black Country. Based on the Water Company forecast consumption figures (Scenario 1), the total demand figure up to 2026 would be 28.48 Mld\(^{-1}\). In the case of the maximum (Scenario 2 – CSH 1/2 120 lh\(^{-1}\)d\(^{-1}\)) and minimum (Scenario 4 – CSH 5/6 80 lh\(^{-1}\)d\(^{-1}\)), the total water demand figures are 28.8 Ml/d and 18.6 Ml/d respectively.

It should be noted that none of these estimates include any allowance for headroom. If an allowance for an additional 10% is added to the demand figures given above, then this would raise the total water demand figures up to 2026 for the maximum (Scenario 1) and minimum (Scenario 4) estimates of 31.72 Mld\(^{-1}\) and 20.42 Mld\(^{-1}\) respectively.

Section 4.5.2.1 explains which of the scenarios above uses the water companies’ assumptions.
### Table 4-4 Non-residential Water Demand in the Black Country

<table>
<thead>
<tr>
<th>Development Areas</th>
<th>Water Co.</th>
<th>Nos. Dwellings (JCS Preferred Option)</th>
<th>Water Company Forecast (see Col 4 - Table 4-3)</th>
<th>Estimate of Water to be supplied for Non-Residential</th>
<th>Development Area (Non-Residential)</th>
<th>Weighting based on Development Area (Non-Residential)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Scenario 1</td>
<td>Scenario 1</td>
<td>Scenario 1</td>
<td>Scenario 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Mld)</td>
<td>(Mld)</td>
<td>Hectares (ha)</td>
<td>(Mld)</td>
</tr>
<tr>
<td>Wolverhampton</td>
<td>ST</td>
<td>14,056</td>
<td>3.72</td>
<td>-</td>
<td>736</td>
<td>2.16</td>
</tr>
<tr>
<td>Walsall</td>
<td>SSW</td>
<td>11,363</td>
<td>3.32</td>
<td>-</td>
<td>799</td>
<td>2.34</td>
</tr>
<tr>
<td>Dudley</td>
<td>SSW</td>
<td>16,127</td>
<td>4.71</td>
<td>-</td>
<td>729</td>
<td>2.13</td>
</tr>
<tr>
<td>Sandwell</td>
<td>SSW</td>
<td>21489</td>
<td>6.28</td>
<td>-</td>
<td>1429</td>
<td>4.18</td>
</tr>
<tr>
<td><strong>Black Country Total</strong></td>
<td></td>
<td><strong>63,035</strong></td>
<td><strong>18.02</strong></td>
<td><strong>10.81</strong></td>
<td><strong>3693</strong></td>
<td><strong>10.81</strong></td>
</tr>
</tbody>
</table>

*1 Assuming 115 l/h/d supplied for ST areas and 127 l/h/d for SSW area. In both cases an occupancy rate of 2.3 assumed (OFWAT Report 2007-08)
*2 Non-residential demand assumed to be 60% of total metered supply (OFWAT 2007-08) [Approx average of ST 58% and SSW 66%]. Note demand estimated on ST forecast (115 l/h/d)
*3 Development areas based on

### Table 4-5 Total Water Demand in the Black Country

<table>
<thead>
<tr>
<th>Development Areas</th>
<th>Water Co.</th>
<th>Total Supply (Residential &amp; Non-residential)</th>
<th>Range of Estimates Minimum</th>
<th>Range of Estimates Maximum</th>
<th>Including an allowance for headroom</th>
<th>Including an allowance for headroom</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Scenario 1 (Mld)</td>
<td>Scenario 4 (Mld)</td>
<td>Scenario 1 (Mld)</td>
<td>Scenario 4 (Mld)</td>
<td>Scenario 1 (Mld)</td>
</tr>
<tr>
<td>Wolverhampton</td>
<td>ST</td>
<td>5.87</td>
<td>4.74</td>
<td>6.03</td>
<td>5.22</td>
<td>6.64</td>
</tr>
<tr>
<td>Walsall</td>
<td>SSW</td>
<td>5.66</td>
<td>4.43</td>
<td>5.48</td>
<td>4.87</td>
<td>6.02</td>
</tr>
<tr>
<td>Dudley</td>
<td>SSW</td>
<td>6.85</td>
<td>5.10</td>
<td>6.59</td>
<td>5.61</td>
<td>7.24</td>
</tr>
<tr>
<td>Sandwell</td>
<td>SSW</td>
<td>10.46</td>
<td>8.14</td>
<td>10.12</td>
<td>8.95</td>
<td>11.13</td>
</tr>
<tr>
<td><strong>Black Country Total</strong></td>
<td></td>
<td><strong>28.84</strong></td>
<td><strong>18.56</strong></td>
<td><strong>28.84</strong></td>
<td><strong>20.42</strong></td>
<td><strong>31.72</strong></td>
</tr>
</tbody>
</table>

*1 Total Supply based on the respective WC's forecast for a residential metered customer (See Table 6.3) and non-residential estimate based on assuming 60% of residential metered figure (see Table 6.4)
*2 The maximum and minimum ranges are based on the different estimates of demand contained in Table 6.3 and with an additional 60% for non-residential demand being added to each column.
*3 Allowance for headroom in-line with WCS Methodology (4/6/08) [+10%]
4.5.3 Water Efficiency

4.5.3.1 Current Situation

A comparison with average water use by different groups of ST and SSW is shown in Table 4-6.

<table>
<thead>
<tr>
<th>Customer Type</th>
<th>ST Customers (lh⁻¹d⁻¹)</th>
<th>SSW Customers (lh⁻¹d⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metered</td>
<td>115</td>
<td>127</td>
</tr>
<tr>
<td>Un-metered</td>
<td>141</td>
<td>148</td>
</tr>
<tr>
<td>Overall</td>
<td>133</td>
<td>144</td>
</tr>
</tbody>
</table>

Source: OFWAT Report 2007-08

ST has one of the lowest metered consumption figures of any UK Water Company, at 115 lh⁻¹d⁻¹ (OFWAT report 2007-08). This compares with an industry average for Water and Sewerage Companies of 131 lh⁻¹d⁻¹. By comparison, SSW metered customers use approximately 127 lh⁻¹d⁻¹, which is just a bit below the water only companies average of 133 lh⁻¹d⁻¹.

In terms of the levels of meter penetration, then this presently stands at 28% in the case of ST and 19% in SSW.

The current levels of leakage as reported by the two companies are 26% in the case of ST and 23% in SSW, as a proportion of the water put into supply (based on 2007/08).

4.5.3.2 Future Water Efficiency Plans (WEP)

Severn Trent’s WEP

A summary of ST’s water efficiency measures included in their draft WRMP (2008) are as follows;

Water Metering – ST are actively encouraging customers to opt for a water meter. No targets have been set for 2020, but 66% are assumed to be metered by 2035.

• Tariffs – no changes are planned.
• Water Efficiency – Good practice guidance is followed where possible (OFWAT 2006).
• Leakage – ST are proposing to operate at below the Economic Level of Leakage¹¹ (ELL) in their areas of most stressed areas, which includes the Black Country.

ST’s Statement of Response has incorporated the most recent evidence which predicts a greater uptake of the free meter option to take place between 2010 and 2015, and also in the longer term. Until the final WRMP has been published, which is subject to approval by DEFRA, there will be no further details available. The statement of response also mentions that the trial to install a meter on a ‘change of occupier’ which was earmarked just for WRZ 2

¹¹ Economic Level of Leakage - The level of leakage for which the cost of achieving and then maintaining that level is exactly offset by savings in capital and operating costs.
(Staffordshire and East Shropshire), will now instead be applied more widely across the ST area, including the WRZ 3 (Severn).

**South Staffordshire Water’s WEP**

A summary of SSW’s water efficiency measures are included in their draft WRMP (SSW, 2008), their Strategic Direction Statement and Statement of Response to the consultation on WRMP:

- **Water Metering** – SSW are hoping to achieve 70-75% meter penetration by 2025/26 and 79% by 2035/36. This will be achieved mainly through the installation of meters on a change of occupier.

- **Tariffs** – the company’s Strategic Direction Statement refers to ‘seasonal tariffs’ being envisaged, although this would require ‘smart meters’ (meters which can be read remotely) to be installed.

- **Water Efficiency** – SSW’s actively promotes reductions in water use and encourages wastage reductions. Cistern devices have been distributed to all properties which have recently had a water meter installed. A trial has also taken place of the provision of a free water butt, in a situation where a home has a change of occupier and which results in a water meter being installed.

- **Leakage** – the company’s leakage levels (72 Mld\(^{-1}\), OFWAT report 2007-08) are currently just below the ELL (ELL reappraised at 74 Mld\(^{-1}\) for the final WRMP). Whilst it will be difficult to maintain leakage at this level with an increasing network, SSW has made a commitment to work towards achieving this (SSW, 2009).

**4.5.4 Code for Sustainable Homes**

The Code for Sustainable homes sets out the maximum water usage permitted for each code level. This provides a flexible outline for improving the overall sustainability of a house. Table 4-7 outlines the water efficiency that needs to be achieved to reach each of the sustainable levels.

The examples of water efficiency measures include in are an outline of the possible ways to improve water efficiency. There are many more possibilities that are site specific. Many of these are shown in the OFWAT water efficiency initiatives for water and sewerage companies and it is recommended that these are assessed and considered for inclusion in new development as part of the Stage 2 strategy as the preferred options for development come forward. Other steps which should be considered in new builds include: rainwater harvesting from roofs and paved areas (through the use of permeable surfaces); grey water recycling (with some mains support) which can provide enough water to run all toilets, a washing machine and outside taps.
Table 4-7: Code for Sustainable Homes – Water consumption targets for the different code levels and examples of how these targets can be attained in new build

<table>
<thead>
<tr>
<th>Code for sustainable homes levels.</th>
<th>Maximum amount of water (litres per person per day)</th>
<th>Examples of how to achieve water efficiency level.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ★</td>
<td>120</td>
<td>Install efficient equipment within the home – 18l max volume dishwasher and 60l max volume washing machine. Install 4/6l dual flush toilets. Install 6-9l/min showers. Educate users about how to be efficient water users. Installation of water meters.</td>
</tr>
<tr>
<td>2 ★★</td>
<td>120</td>
<td>As above. Install flow regulators into bathrooms and kitchens. To reduce flow rate of taps to 3 l/min and showers to a maximum flow rate of 6 l/min. Specify ‘low volume’ baths with the levels of overflow pipes at lower than normal levels to prevent over-filling.</td>
</tr>
<tr>
<td>3 ★★★</td>
<td>105</td>
<td>As above, in addition: Grey water recycling for toilet flushing. Provide water audits for people to show them where they can reduce water usage.</td>
</tr>
<tr>
<td>4 ★★★★</td>
<td>105</td>
<td></td>
</tr>
<tr>
<td>5 ★★★★★</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>6 ★★★★★★</td>
<td>80</td>
<td></td>
</tr>
</tbody>
</table>

New developments offer the opportunity to work towards a much higher level of water efficiency, the eco-towns water cycle worksheet shows examples of where community schemes have been used as a way to improve efficiency for example, through the collection and supply of rainwater for use in toilets; these kind of initiatives could be considered for the Black Country on a strategic scale to further reduce water demand.

4.5.4.1 Water Neutrality

Water Neutrality is an aim for any development, (new housing or new employment) to ensure that development should not lead to an overall rise in demand for water. In reality, some ‘clean’ water will always be required for drinking water supplies. The ‘key’ to sustainable development is through a combination of water efficiency measures (as described above) and SUDS (Sustainable Drainage Systems) techniques to try and reduce the impact on the environment. Examples of SUDS techniques which may reduce the impact, include rainwater harvesting (e.g. water butts) and grey water recycling (e.g. drain water from showers, baths and sinks) to help reduce impacts. This could be a long term goal for the Black Country Authorities to consider adopting.

Table 4-8 contains Scott Wilson’s initial assessment of the potential benefits from adopting a Water Neutrality position on all future residential development within the Black Country.

The principles behind this assessment are that within the Black Country water savings equivalent to the amount of extra demand generated by the 63,000 new homes would need
to be met from a reduction of water usage by existing households. Bearing in mind that metered customers are one of the lowest users already of water (at least amongst ST customers), then the main savings would be most likely from existing non-metered customers. The estimate of the number of homes without a water meter is 332,000 across the Black Country. The average water saving required by each existing property has been calculated as 54 litres/property/day (lp\(^{-1}\)d\(^{-1}\)) (or equivalent to 22 lh\(^{-1}\)d\(^{-1}\) based on an average occupancy rate of 2.45 for this group of customers).

The savings outlined above would require a reduction in current water usage rates from around 141 lh\(^{-1}\)d\(^{-1}\) to 120 lh\(^{-1}\)d\(^{-1}\) in the ST area (Wolverhampton) and from 148 lh\(^{-1}\)d\(^{-1}\) to 126 lh\(^{-1}\)d\(^{-1}\) in SSW area (Walsall, Dudley and Sandwell). In the case of both ST and SSW, this would bring the water usage rates amongst their un-metered customers down to levels equivalent to those used by metered customers (see Table 4-6). These water usage rates are also equivalent to just above the level required in order for dwellings to meet the CSH Standard Level 1/2 (120 lh\(^{-1}\)d\(^{-1}\)).

It is Scott Wilson’s view that these are realistically achievable targets for the Black Country Authorities to aim for in its WCS.
Table 4-8 Summary of Water Neutrality Calculations

<table>
<thead>
<tr>
<th>Development Areas</th>
<th>Water Co.</th>
<th>Nos. of Dwellings (JCS Preferred Option)</th>
<th>Water Company Forecast Scenario 1 (Mld(^1))</th>
<th>Nos. of Existing Dwellings (2006)</th>
<th>Nos. dwellings without a water meter</th>
<th>Average Savings per Property (lp d(^{-1}))</th>
<th>Average Saving per Person (lh d(^{-1}))</th>
<th>Target Water Use Rate</th>
<th>Closest CSH Standard to be achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wolverhampton</td>
<td>ST</td>
<td>14,056</td>
<td>3.72</td>
<td>103,093</td>
<td>74,227</td>
<td>50.09</td>
<td>20.87</td>
<td>120</td>
<td>Level 1/2</td>
</tr>
<tr>
<td>Walsall</td>
<td>SSW</td>
<td>11,363</td>
<td>3.32</td>
<td>106,186</td>
<td>76,454</td>
<td>43.41</td>
<td>17.36</td>
<td>131</td>
<td>Above Level 1/2</td>
</tr>
<tr>
<td>Dudley</td>
<td>SSW</td>
<td>16,127</td>
<td>4.71</td>
<td>130,928</td>
<td>94,268</td>
<td>49.97</td>
<td>19.99</td>
<td>128</td>
<td>Above Level 1/2</td>
</tr>
<tr>
<td>Sandwell</td>
<td>SSW</td>
<td>21,489</td>
<td>6.28</td>
<td>121,649</td>
<td>87,587</td>
<td>71.66</td>
<td>28.66</td>
<td>119</td>
<td>Just below Level 1/2</td>
</tr>
<tr>
<td><strong>Black Country Total</strong></td>
<td></td>
<td><strong>63,035</strong></td>
<td><strong>18.02</strong></td>
<td><strong>461,856</strong></td>
<td><strong>332,536</strong></td>
<td><strong>54.20</strong></td>
<td><strong>22.12</strong></td>
<td><strong>122</strong></td>
<td>Just above Level 1/2</td>
</tr>
</tbody>
</table>

\(^1\) Assuming 115 lh d\(^{-1}\) supplied for ST areas and 127 lh d\(^{-1}\) for SSW areas. In both cases occupancy rate of 2.3 assumed (OFWAT 2007-08)

- Water Company ST SSW
- % without water meter 72% 81%
- Occupancy Rates (un-metered customers) 2.4 2.5
- Water consumption (un-metered households) lh/d 141 148
4.5.5 Environmental Baseline – Source Protection Zones and Groundwater Vulnerability

4.5.5.1 Source Protection Zones (SPZ)

The quality of groundwater aquifers is determined by the level and nature of surface pollutants permitted to reach them. The EA has established and enforces groundwater Source Protection Zones (SPZs) to protect groundwater sources such as wells, boreholes and springs used for public drinking water and commercial food and drink production. There are currently over thirty SPZs within the Black Country. The Inner SPZ (red) and Outer SPZ (green) have different shapes and sizes depending on the condition of the ground, how the groundwater is removed and other local environmental factors. The total catchment areas (blue) needed to support the removal of water from the source tend merge into one large area that matches closely with the areas of Major Aquifer (see Section 4.5.5.2).

4.5.5.2 Groundwater Vulnerability

Groundwater resources are vulnerable to contamination from both direct sources (into groundwater) or indirect sources (e.g. infiltration of discharges from overlying land). Groundwater vulnerability within the Black Country has been determined by the EA based on a review of aquifer characteristics, local geology and the vulnerability of soils. The classification divides the area up into three categories; Major Aquifer, Minor Aquifer and Non-aquifer. The Sherwood Sandstone Aquifer which forms a ring around the edge of the Black Country is classified as a Major Aquifer. The central part of Staffordshire Basin containing older Carboniferous age formations is classified as a Minor Aquifer.

The vulnerability of the groundwater is important when advising on the suitability of SUDS (see section 7.1.1). In general, development sites which take place on Major Aquifers tend to provide more options in terms of being able to return surface runoff back to ground, than is the case with either Minor Aquifers or Non-aquifers. Developments on Major Aquifers do however need to be mindful of the impacts which they may pose to groundwater and which may in turn affect the public water supply sources. Site specific hydrogeological assessments should be carried out on all development sites situated on Major Aquifers.

4.5.6 Potential Risks to Water Supplies

Potential risks to water company supplies which may affect the Black Country, include;

- Review of Consents process – this relates to investigations being undertaken by the EA on various abstractions and their impacts on designated sites. SSW has three groundwater abstractions under investigation at Hagley, Churchill and Ashwood in South Staffordshire. Reductions in Deployable Output\(^\text{12}\) (DO) may be required in all three cases and this would

\[^{12}\text{Deployable Output - The output of a commissioned source or group of sources or of bulk supply as constrained by the following for specified conditions and demands:}\]
- environment
- licence, if applicable
- pumping plant and/or well/aquifer properties
- raw water mains and/or aqueducts
- transfer and/or output main
- treatment
- water quality
reduce the amount of headroom available to meet future growth. ST also has a number of sites under investigation and they have made a commitment not to include any new water resource investment options that could impact on those sites still under investigation by this process.

- Climate Change (CC) – 60% of water supplies for the Black Country come from surface water which will be affected by climate change. Groundwater sources are generally less affected by climate change. Under the mid-range CC scenario, the reduction in SSW’s average DO would be less than 1% (or around a 2-3 Mld\(^{-1}\) reduction from its River Severn and Blithfield Reservoir sources). In the case of ST, surface water impacts are again the most significant, with the Statement of Response (SSW, 2009) indicating an even greater impact from CC than was originally forecast in the draft WRMP. Under the mid-range CC scenario, ST’s reduction in their average DO would be around 64 Mld\(^{-1}\) within the Severn WRZ (equivalent to a 10% reduction in DO). The effects of climate change are also taken into account in their water demands and headroom calculations undertaken for the final WRMP.

- Groundwater quality within aquifers – this is a major concern to ST, who predicts that increasing nitrate concentrations will mean many groundwater sources will no longer be suitable for water supplies. A failure to fund and implement a series of AMP5 schemes to treat and blend high nitrate water could mean further increases in the supply/demand gap, in addition to the sizeable deficits already identified within the Severn WRZ (see Section 4.5.1.1). As part of its commitment to the Water Framework Directive River Basin Management Plans, ST is also proposing to implement catchment solutions instead of and in parallel to treatment solutions, for both nitrate and other water quality problems. This will involve working closely with NE to manage catchments to reduce the need for higher levels of treatment in future.

- Water supply resilience – all new (and existing) water supplies should be resilient, whereby if the standard means of water provision is interrupted (be that from physical or chemical mechanisms) then there are alternative means by which supplies of potable water can be maintained. In general, the Black Country water supply system is well connected, allowing the re-distribution of potable water. This is something which must be incorporated into the design of any new development areas which are being proposed within the Black Country.

### 4.6 Water Resources and Water Supply Summary

The overall picture indicates:

- The proportion of water supplies for the Black Country coming from surface water and groundwater sources is roughly 60:40.

- In general, the CAMS document for the area show the River Severn to either have ‘No Water Available’ or ‘Over-abstracted’ (in the Rivers Stour, Worfe and Salwarpe, and associated groundwater bodies).
• The EA assessed the Black Country as lying within an area of moderate water stress.\(^{13}\)

• The Black Country is served by two water companies, ST and SSW. The parts of the Black Country lying within ST’s Severn WRZ 3 are the areas around Wolverhampton and also southwest corner of the Black Country around Stourbridge and Halesowen. SSW provides water only services for the four population centres of Dudley, Sandwell and Walsall.

• ST’s draft WRMP indicates a supply/demand shortfall within the Severn WRZ 3 over the entire planning period through to 2035. Their final WRMP is due to be published shortly (subject to DEFRA’s approval) is likely to indicate a worsening position in terms of deficits once the latest effects of Climate Change are included. As a result, ST is now proposing resources schemes (mainly groundwater) and demand management measures within WRZ 3.

• In the case of SSW, their position is one of having sufficient resources to meet the forecast growth in demand plus target headroom for both the annual average and peak week conditions throughout the plan period to 2035. Demand management measures are therefore all that will be required by SSW.

• ST and SSW have both assumed the growth contained within the WMRSS, JCS growth figures are slightly above those contained with the RSS.

• Under the proposed JCS and based on Water Company consumption figures (Scenario 1), the total residential water demand for the Black Country up to 2026 would be 18 Mld. Broken down into the individual population centres, then the demands are highest in Sandwell (6.3 Mld) and lowest in Walsall (3.3 Mld), although Wolverhampton (3.7 Mld) is broadly similar.

• An estimate for the total non-residential demand for the Black Country up to 2026 would be 10.8 Mld (Scenario 1, Water Company forecast). The largest growth in the non-residential demand would come from the Sandwell area (4.18 Mld), whilst the growth the other three population centres is between 2.1 to 2.3 Mld.

• Both ST and SSW recognise the importance of water efficiency in managing the future growth in demand within the Black Country. Leakage control will continue to play an important part, although it has to be recognised that maintaining leakage at existing levels with an increasing network will require a significant commitment from both water companies.

• Scott Wilson’s initial assessment of the potential benefits from adopting a Water Neutrality position on all future residential development within the Black Country would indicate that it is a realistically achievable target for the Black Country Authorities to aim for in its WCS. In order to achieve this would require the 332,000 currently unmetered households to reduce their water consumption to rates equivalent to just above the level required in order for dwellings to meet the CSH Standard Level 1/2 (i.e. around 120 lh\(^{-1/d}\)).

• There are currently over thirty Source Protection Zones within the Black Country area. The presence of a Major Aquifer, the Sherwood Sandstone Aquifer of the Staffordshire Basin, will be an important consideration when selecting which types of SUDS techniques are most appropriate for different development areas.

\(^{13}\) The EA have classified all Water Company supply areas in England according to water stress based on the demand levels for water against available raw resources. Moderate Stress indicates that water use and population is high in relation to available resources and that careful planning of development is required to ensure that the environment is not harmed by further abstraction.
• Other potential risks to water supplies within the Black Country include: Review of Consent process, Climate Change, groundwater quality/WFD issues and water supply resilience issues.
5 Flood Risk Management, SUDS and Surface Water Management

5.1 Introduction

A review of flood risk in the WCS is essential to ensure that:

- The risk of flooding to the broad growth areas is quantified and the development is steered away from high risk areas (Flood Zone 2 and Flood Zone 3);
- Any flood mitigation measures are planned in a strategic manner; and
- There is no deterioration to existing communities’ standard of protection.

5.2 Catchment Description

The River Tame is a major tributary of the River Trent and its catchment covers large areas of Walsall and Sandwell. It rises to the south of Walsall on moderately permeable Lower Westphalian geology (dominated by Coal Measures) in the Black Country, and flows north east to join the River Trent at Alrewas. The primary geology of the catchment is Mercia Mudstone mixed with Sherwood Sandstone. Relatively impermeable loamy clay soil overlies the geology and resulting high percentage of the of runoff. Runoff is accentuated by the urban nature of much of the catchment, especially in its upper reaches.

The headwaters of the Tame upstream of Walsall drain relatively high, sloping ground with a fast runoff response to rainfall. The river then flows eastward through the highly urbanised West Midlands conurbation and gains more flow from the high urban runoff. As a result of these high runoff rates, storms frequently result in fluvial and surface water. The southern arm of the River Tame (the Oldbury Arm), runs south to north through Sandwell.

The River Stour flows through the south of the study area including large parts of Dudley. The catchment is underlain by a mixture of moderately permeable Permian and Sherwood Sandstones, Lower Westphalian geology (mainly productive Coal Measures) along with Westphalian and Stephanian Barren Red geology to the east. Relatively impermeable soils overlay the geology and resulting high runoff coefficient. Runoff is accentuated by the urban nature of much of the catchment. The Stour eventually flows into the River Severn at Stourport-on-Severn.

5.3 Flood Risk Identification Methodology

The aim of identifying the potential sources of flood risk to the study areas is to assess the risks of all forms of flooding to and from development, in order to identify any potential development constraints with respect to flood risk. PPS25 emphasises the need for a risk-based approach to be adopted by LPAs through the application of the Source-Pathway-Receptor (SPR) model.

The SPR model firstly identifies the sources of flooding to and from a development. The identification is based on a review of local conditions and consideration of the effects of climate change. The nature and likely extent of flooding arising from any one source is considered, e.g.
whether such flooding is likely to be localised or widespread. The presence of a flood source does not always infer a risk. The exposure pathway or ‘flooding mechanism’ determines the risk to the receptor and the effective consequence of exposure. For example, sewer flooding does not necessarily increase the risk of flooding unless the sewer is local to the site and ground levels encourage surcharged water to accumulate. The varying effect of flooding on the ‘receptors’ depends largely on the sensitivity of the target. Receptors include any buildings within the range of the flood source, which are connected to the source by a pathway.

In order for there to be a flood risk, all the elements of the model must be present. Furthermore effective mitigation can be provided by removing one element of the model, for example by removing the pathway or receptor. In the case of the Black Country, the general consensus is that the receptor (i.e. new development) should be avoided via the planning process.

5.4 Current Flood Risk to Development Areas

5.4.1 Fluvial Flood Risk

The primary fluvial flood risk sources within the study are:

- River Tame;
- River Stour;
- Ford Brook;
- Smestow Brook; and
- Illey Brook.

The EA Flood Zones and Flood outlines produced for the River Tame Strategy suggest that the areas identified in Table 5-1 are currently at risk of flooding from the watercourses stated above.

<table>
<thead>
<tr>
<th>Sandwell</th>
<th>The Woods</th>
<th>Yew Tree</th>
<th>Great Bridge</th>
<th>Horsely Heath</th>
<th>North East Oldbury</th>
<th>Friar Park</th>
<th>Metsy Croft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walsall</td>
<td>Bescot</td>
<td>North East Darlaston</td>
<td>Willenhall</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wolverhampton</td>
<td>Stow Lawn</td>
<td>Bilston</td>
<td>Castlecroft</td>
<td></td>
<td>Pendeford</td>
<td>North of Bushbury</td>
<td></td>
</tr>
<tr>
<td>Dudley</td>
<td>Bramford</td>
<td>Wall Heath</td>
<td>Buckpool</td>
<td>Wollaston</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Halesowen</td>
<td></td>
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</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cradley</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lye</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Norton</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Reviews of the Level 1 Black country SFRA and Level 2 SFRAs, and meetings with Council drainage engineers have identified numerous recent fluvial flooding instances, although the dates and extents are frequently not recorded. Table 5-2 below details some of these incidents.

<table>
<thead>
<tr>
<th>Watercourse</th>
<th>Area</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>River Stour</td>
<td>Overend</td>
<td>2007</td>
</tr>
<tr>
<td>River Stour</td>
<td>East Halesowen</td>
<td>2007</td>
</tr>
<tr>
<td>River Stour</td>
<td>SE Halesowen</td>
<td>2008</td>
</tr>
<tr>
<td>Pendeford Brook</td>
<td>Pendeford</td>
<td>1998</td>
</tr>
<tr>
<td>Oxley Brook</td>
<td>Oxley</td>
<td>1998</td>
</tr>
<tr>
<td>River Tame</td>
<td>Bentley</td>
<td>2000</td>
</tr>
<tr>
<td>River Tame</td>
<td>Bescot/Palfrey</td>
<td>2007</td>
</tr>
<tr>
<td>Sneyd Brook</td>
<td>Leamore</td>
<td>2008</td>
</tr>
</tbody>
</table>

5.5 Potential Flood Risk from Development

If new development is planned for greenfield sites, or upstream of areas with known flood risk, it is essential that any additional surface and wastewater generated due to the increase in permeable area is mitigated to greenfield runoff rates to avoid increasing flood risk elsewhere. This could be achieved through careful development layout and the use of SUDS.

5.5.1 National Flood Risk Policy: PPS25

Planning Policy Statement 25 (PPS25): Development and Flood Risk requires that all new development should ensure that runoff rates and runoff volumes from new development are not increased above that of the existing land use. For any development on currently undeveloped land, there will be a requirement to ensure that runoff rates and volumes are no greater than the greenfield rates for the design event with return period of 1 in 100 years (with an allowance for climate change) and smaller rainfall events up to this level.

It is important to note that whilst the majority of the proposed development sites are on existing brownfield sites, the latest EA guidance states that runoff should be limited to that of greenfield rates, thereby requiring less runoff to watercourses and/or adjacent development areas than that currently experienced.

PPS 25 also advocates the use of the sequential approach. The sequential approach is a simple decision-making tool designed to ensure that sites at little or no risk of flooding are developed in preference to areas at higher risk. It can be applied at all levels and scales of the planning process, both between and within Flood Zones. All opportunities to locate new developments (except water-compatible) in reasonably available areas of little or no flood risk should be explored, prior to any decision to locate them in areas of higher risk.

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The Sequential Test refers to the application of the sequential approach by LPAs. This allows the determination of site allocations based on flood risk and their vulnerability. Development should be directed towards Flood Zone 1 wherever possible, and then sequentially to Flood Zone 2 and Flood Zone 3.

The application of the sequential approach aims to manage the risk from flooding by avoidance. This will help prevent the promotion of sites that are inappropriate on flood risk grounds. The application of the Exception Test through a Level 2 SFRA will ensure that new developments in flood risk areas will only occur where flood risk is clearly outweighed by other sustainability drivers and mitigation measures are provided.

The LPA must demonstrate that it has considered a range of possible sites in conjunction with the Flood Zone information from the SFRA and applied the Sequential Test and where necessary the Exception Test (see Appendix D of PPS25) in the site allocation process. In cases where development cannot be fully met through the provision of site allocations, LPAs are expected to make a realistic allowance for windfall development based on past trends.

Further detailed information regarding the application of the Sequential approach can be found in the Black Country SFRA.

The following points highlight key national, regional and local flood risk policy guidance.

### 5.5.2 National

- In accordance with PPS25, all sites should be allocated in accordance with the Sequential Test to reduce the flood risk and ensure that the vulnerability classification of the proposed development is appropriate to the Flood Zone classification,

- FRAs should be undertaken for all developments within Flood Zones 2 and 3 and sites with identified flooding sources (according to PPS25 Annex E) to assess the risk of flooding to the development and identify options to mitigate the flood risk to the development, site users and surrounding area,

- FRAs are required for all major developments in Flood Zone 1 (according to PPS25 Annex E). These are residential developments consisting of sites greater than 1 ha or greater than 10 dwellings and commercial developments that are greater than 1 ha or have a floor area greater than 1,000 m$^2$,

- Flood Risk to development should be assessed for all forms of flooding (in accordance with PPS25 Annex E),

- According to PPS25, it is recommended that where floodplain storage is removed, the development should provide compensatory storage on a level for level and volume for volume basis to ensure that there is no loss in flood storage capacity.
5.5.3 Sub-Regional / Local

- As stated in PPS25, surface water flooding should be investigated in detail as part of site specific FRAs for developments and early liaison with the EA and the relevant LPA for appropriate management techniques should be undertaken.

- As stated in PPS25, groundwater flooding should be investigated in more detail as part of site specific FRAs.

5.6 Residual Risk Management

Residual risk in a generic sense can be defined as being the remaining risk following the implementation of all reasonable risk avoidance, reduction and mitigation measures. In a flood risk context, this residual risk pertains to that remaining after flood avoidance and alleviation measures have been put in place. Examples of such residual risks include overtopping or breaching of flood walls or embankments.

Residual risk management therefore aims to prevent or mitigate the consequences of flooding that can occur despite the presence of flood alleviation measures.

Application of the Sequential Test as part of PPS25 aims to preferentially develop or relocate potential development sites into areas with low flood risk. Where this is not realistically possible, some development sites may be located in higher flood risk areas, such as PPS25 defined Flood Zones 2 and Flood Zone 3. As a result, such developments will require residual risk management to minimise the consequences of potential flooding, e.g. following a breach or overtopping of local flood risk management structures.

Ensuring properties are defended to an appropriate design standard reduces flood risk. However, further options are also available should the residual risk to a development prove unacceptable. The following residual risk options should be considered as part of site specific flood risk assessments.

5.6.1 Identification of Potential Evacuation and Rescue Routes

In the event of a flood incident, it is essential that the evacuation and rescue routes to and from any proposed development remain safe. The EA deem evacuation routes safe if they fall within the white cells of Table 13.1 of the DEFRA/EA document FD2320 for a 1 in 100/200 year design event as a minimum, and the EA inform LPAs of the risk posed during the extreme event (1 in 1000 year). This allows the LPA to consult with the emergency services over the suitability of the access route. When considering plans for individual developments, emergency services should consider the potential for widespread flooding and the consequential impacts on their resources. If potential evacuation routes are likely to become inundated so that safe access/egress would not be possible, then the proposed development should be relocated. This may also be the case should the possible evacuation routes be particularly long or across difficult terrain.

A key consideration in relation to the presence and use of evacuation routes is the vulnerability and mobility of those in danger of being inundated. Development for vulnerable users e.g. disabled or the elderly should be located away from high-risk areas. The Sequential Test does not, however, differentiate between the vulnerability of the end users of the site, only the
vulnerability of the intended use of the site. A proposed residential development for highly vulnerable end users will still fall under the ‘More Vulnerable’ classification in Table D.2 of PPS25 and the Sequential and Exception Tests will apply accordingly. Where development for highly vulnerable end users cannot be avoided, safe and easy evacuation routes are essential.

5.6.2 Time to Peak of Flood Hazard

Identification of the time to the peak of the flood hazard relates to the amount of time it takes for a flood event to reach its maximum level, flow or height. The greater the time to peak, the greater the time available for evacuation. The time to peak can, for residual flooding, be very short. Should a defence structure breach then inundation can be rapid, resulting in a short time to peak for the areas local to the breach. Typically, areas immediately adjacent to a breach location will have a shorter time to peak than areas setback from the flood defence.

5.6.3 Methods of Managing and Mitigating Residual Flood Risk

Many techniques are available to manage and mitigate against residual flood risk. These include:

- Setting aside higher risk land for recreation, amenity and ecology. These areas of open, undeveloped space can provide areas for flood water storage.

- Construction of secondary flood risk management structures can relocate floodwaters away from certain areas or reduce the rate of flood inundation following a residual event. Examples of secondary flood risk management structures include embankments or raised areas behind flood defence walls, raised infrastructure e.g. railways or roads and on a strategic level, canals, river and drainage networks. The latter are a form of secondary defence as they are able to convey or re-direct water away from flood prone areas even if this is not their primary function.

- Finished Floor Levels Where developing in flood risk areas is unavoidable, the most common method of mitigating flood risk is to ensure habitable floor levels are raised above the maximum flood water level. Finished Flood Levels (FFLs) should be considered at the same time as access and egress to ensure that residents are not trapped by flood water, and in close consultation with the EA.

- Flood resilience is a damage limitation measure to reduce the consequence of flooding and should not be used as justification for inappropriate development in flood risk areas. The Association of British Insurers (ABI) in cooperation with the National Flood Forum has produced published guidance on how homeowners can improve the flood resilience of their properties (ABI, 2004). The guidance identifies the key flood resistant measures as being:
  - Replace timber floors with concrete and cover with tiles,
  - Replace chipboard/MDF kitchen and bathroom units with plastic equivalents,
  - Replace gypsum plaster with more water-resistant material, such as lime plaster or cement render,
  - Move service meters, boiler, and electrical points well above likely flood level,
Put one-way valves into drainage pipes to prevent sewage backing up into the house.

- Flood warning and emergency procedures are typically higher-level management strategies and should not be considered as a solution for flooding problems or a way of avoiding provision for safe and dry access and egress. In addition, when deriving flood warning and emergency procedures, the reluctance of residents to vacate premises upon receipt of a warning or during a flood event should not be under-estimated.

5.7 Fluvial Flood Risk Summary

The Black Country SFRA (Jacobs, 2009) summarises that:

“There are few open watercourses flowing evident within the Sub region, and the risk of fluvial flooding is relatively low. Notwithstanding this however, the heavily urbanised nature of the Sub region, and steep sided valleys, result in quite a high susceptibility to localised surface water flooding during periods of intense rainfall. Furthermore, whilst many of the culverts within the Sub region have a sizeable capacity, there always remains a potential risk of blockage, resulting in localised flooding”
6 Scoping Stage Surface Water Management Plan

6.1 Background and Aims

The Final Technical Report for the Scoping-Level SWMP has been produced to support the Joint Core Strategy which is currently being prepared by the four Councils in the Black Country. Its purpose is to provide clear guidance and a summary of technical recommendations to address surface water management and integrated drainage up to 2026. This report covers the following surface water-related issues:

- Forms of flooding / mechanisms of flooding;
- Surface water flood risk issues across the Black Country;
- Challenges in identifying Critical Drainage Areas (CDAs) in the Black Country;
- Opportunities for de-culverting through an scoping-level River Corridor Improvement Plan (RCIP);
- Tools for information sharing and improved management of drainage assets;
- Preliminary Action Plan & scope for further work.

6.2 Summary of Initial Consultation and Data Collection

Data was collected through several on-site field visits (including one with each of the LPA drainage departments) and through a review of technical data obtained from Key Stakeholders (EA, BW and ST). Table 6-1 provides a summary of documents reviewed when undertaking this study.

<table>
<thead>
<tr>
<th>Stakeholder organisation</th>
<th>Data collected</th>
<th>Data gaps for an outline &amp; detailed SWMP</th>
</tr>
</thead>
</table>
| Local Planning Councils  | - Black Country Level 1 Strategic Flood Risk Assessment (SFRA)  
- Historic flood event data  
- Wolverhampton Level 2 SFRA  
- Maintenance regimes  
- Historic flood event data.  
- Photographs from past flooding events (Walsall)  
- Map of historical industrial water abstractions (Wolverhampton)  
- Map of open and culverted watercourses (Walsall and Wolverhampton) | - Detailed river modelling of the Frood Brook through Walsall  
- Historic groundwater flooding events data  
- Capacity and condition of ordinary watercourses  
- Highways drainage records (location and serviceability of road gullies) |
| Environment Agency       | - Catchment Flood Management Plans (CFMPs) | - Surface Water Susceptibility Maps  
- Culverts data |
Stakeholder organisation | Data collected | Data gaps for an outline & detailed SWMP
--- | --- | ---
Severn Trent Water | None | - Maintenance Program
British Waterways | - Map of canal network<br>- List of canal overtopping issues | Maintenance Programme
British Geological Society | 1:50,000 solid and drift geological maps | None
Local Resilience Forum | None | - Location of critical infrastructures<br>- Existing incident management plans
Met Office | None | Rainfall data and frequency analyses

6.3 Preliminary Identification of Flood Risk Issues from All Sources (Preparation and Initial Risk Assessment)

6.3.1 Summary

The data collected, as well as the site visits and interviews undertaken have enabled to obtain a high level picture of the situation of the Black Country towards flood risk from all sources. The following issues (technical, economical or institutional) that are linked to flood risk management are listed in Table 6-2.

Table 6-2 - Preliminary Identification of Flood Risk Issues

<table>
<thead>
<tr>
<th>No.</th>
<th>Issue</th>
<th>Description of Issue</th>
<th>Supporting Sections</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lack of communication plan / interaction between key organisations</td>
<td>It has been reported during our site visits with the Local Authority Drainage Engineering Departments that very little is known about other stakeholders’ operational procedures, emergency response plans, flood risk assets and investment / maintenance programs. In the Black Country area, surface water flooding issues are highly interlinked, notably because of the presence of a relatively dense canal network and significant lengths of culverted watercourses. Information regarding future maintenance works should be communicated when expected to impact other stakeholders’ assets (e.g. canal maintenance works impacting river flows).</td>
<td>6.8 &amp; 6.10</td>
</tr>
<tr>
<td>2</td>
<td>De-centralisation of knowledge and databases</td>
<td>Fragmentation of responsibilities and administrative arrangements has resulted in a de-centralisation of knowledge and databases. This situation has become problematic during recent flood events (2007 &amp; 2008) when both Operational and Emergency responses were required, and offers little coherence in the management and recording of flood events.</td>
<td>6.4 &amp; 6.10</td>
</tr>
<tr>
<td>No.</td>
<td>Issue</td>
<td>Description of Issue</td>
<td>Supporting Sections</td>
</tr>
<tr>
<td>-----</td>
<td>-----------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>3</td>
<td>Lack of coordinated response in the management of flood events and post-event resolution of responsibility</td>
<td>The fragmentation of responsibilities in the management of urban drainage assets generates inefficiencies following road flooding incidents, as in many cases it is not clear which asset failed (gully pot, the connection pipe or trunk sewer). A procedure needs to be set up where responsibility can be attributed on the basis of the most up-to-date information available for a given area (last maintenance works carried out, actual sewer capacity and area drained, etc.). This will aid in diagnosing the issue and with downstream post-flood event public surgeries.</td>
<td>6.10</td>
</tr>
<tr>
<td>4</td>
<td>Control the impacts of drainage from new developments</td>
<td>Flood risk may arise from areas previously un-developed where runoff contribution are expected to increase significantly, potentially putting downstream existing urban areas at risk of surface water flooding. Based upon our initial data collection and interviews with the LPA Drainage Engineers, it appears that there may have been missed opportunities to shape the final drainage layout of proposed new developments. Also, it has been reported that when development proposals are put forward, the Council’s Drainage Engineers make recommendations (when consulted) to assess the capacity of the storm/combined sewer before the proposed development goes forward but often get no feedback from ST regarding the capacity of their sewer system to accommodate additional inflows from the new development. It appears that there may be missed opportunities within the planning-phase of a development scheme whereby the Council Drainage Engineers could play a larger role on the final drainage layout of the site, given this could have an impact upon maintenance regimes (e.g., trash screen clearing at sensitive culvert locations). Their local knowledge could also be better used to shape the final drainage layout if significant impacts are spotted early in the planning and design phases. The lack of a defined river corridor including appropriate buffers for development has resulted in extensive culverting (approximately 105 km within the study area). This legacy of assets (culverts and trash screens) is expensive to maintain and often contributes to increased flood risk and flood impact through blockages. We recommend a stronger adaptation to the principles of Making Space for Water through the creation of a RCIP.</td>
<td>5, 6.4 &amp; 6.10</td>
</tr>
<tr>
<td>5</td>
<td>Multiple and interlinked sources of flooding</td>
<td>Past flood events throughout the Black Country revealed that the causes of surface water flooding can be difficult to identify due to the multiple interactions between component parts of the drainage system (sewer and gully networks, water levels in receiving watercourses, canals, culverted watercourses, trash screens, etc.). Implementation of future drainage schemes may be made inefficient if</td>
<td>6.4 &amp; 6.8</td>
</tr>
<tr>
<td>No.</td>
<td>Issue</td>
<td>Description of Issue</td>
<td>Supporting Sections</td>
</tr>
<tr>
<td>-----</td>
<td>-------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>5</td>
<td>another element of the drainage network is not maintained or upgraded. A relatively simple tool (e.g., drainage asset register) is the first step toward a holistic understanding of the entire drainage network. We recommend the development of a drainage asset register to help with the understanding of asset ownership and condition. The drainage asset register could have a secondary benefit whereby it could be used to help with identification of the causes &amp; mechanisms of flooding, for post-event responsibility attribution.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Land contamination &amp; SUDS</td>
<td>The industrial heritage of the Black Country has left significant land contamination issues that may have an impact upon water sustainable management. Even in areas where ground conditions may be favourable to infiltration techniques, land contamination needs to be systematically investigated to determine whether SUDS are suitable as this will restrict the range of available drainage options.</td>
<td>6.7</td>
</tr>
<tr>
<td>7</td>
<td>Groundwater flooding</td>
<td>Groundwater flooding is an issue in the Black Country as a result of the halt of major industrial abstractions and associated groundwater recharge/rising (the primary Boroughs at risk based upon our initial data collection are Sandwell and Wolverhampton). Currently very little is known on past groundwater flooding incidents and the extent and mechanism of groundwater flooding can be difficult to diagnose. More groundwater levels are needed throughout the study area to better assess the suitability of infiltration techniques (as there may be restriction where the water table is high), the rate of groundwater level rise (taking into account historical, pre-industrial groundwater levels) and the groundwater flood risk.</td>
<td>6.5</td>
</tr>
<tr>
<td>8</td>
<td>Lack of knowledge transfer within organisations.</td>
<td>Most of the Councils in the Black Country have some knowledge of local flood hot spots. A potentially significant issue for the future is the lack of knowledge transfer between individuals who hold vast amounts of information from 20-25 years of local drainage experience. There is a risk that this expertise and knowledge may be entirely lost once key-staff members retire (or as these skills become dissipated naturally with time), hence the need for archived and updated databases, resource pooling between neighbouring Councils and clear succession plans for future Drainage Engineers.</td>
<td>6.4 &amp; 6.10</td>
</tr>
</tbody>
</table>

6.3.2 Challenges in Identifying Critical Drainage Areas in the Black Country

The assessment of flood risk from all sources detailed hereafter (Sections 6.4, 6.5 & 6.6) is primarily based on historical flood incidents that were reported within the Black Country. This list was initially provided by the Local Authorities. It has then been compiled with other flood incidents reported in the Severn Catchment Flood Management Plan, and refined with additional information provided by the Drainage Engineering teams of all four Boroughs. This has enabled an initial classification of flood incidents by the following flooding mechanisms, to be prepared:

- canal overtopping;
• culvert blockage;
• drainage system exceedance;
• fly-tipping;
• groundwater flooding;
• river flooding;
• surface water runoff;
• unknown source.

The resulting Table 6-3 presented overleaf, as well as the mapped outputs presented for each Local Authority in Figures 6-1 to 6-4, show that flood risk issues in the Black Country are widely dispersed.

This means that the identification of Critical Drainage Areas (CDAs) in the Black Country area is inherently problematic (i.e. there is no single "smoking gun"). This also leads to technical challenges with the selection of an appropriate tool to assess risk and appraise options for multiple flood risk sources in widely scattered urban areas.

With no particular flooding "hot spot" in the Black Country, perhaps with the exception of the Oxley Brook in Wolverhampton and the M6 culvert in Sandwell, determining the appropriate scale and method of urban pluvial modelling is a challenge.

When considering that flood risk issues in the Black Country are polycentric, this creates challenges in the long term operational management of flood risk as well as future investment of drainage schemes.

Given that there are multiple Critical Drainage Areas, Figure 6.5 represents focus areas where there will need to be a broad stakeholder discussion and agreements as to the best way forward. This discussion will need to include key stakeholders in the Black Country and may need to expand to include Network Rail and the Highways Agency as key asset owners.

**Figure 6.5 - Excerpt of Surface Water Management Plan Framework**

1. **Preliminary risk Assessment**
   Site visit, data collection & analysis

2. **Map Flood Risk from all sources (based on existing data)**
   Required for EU Floods Directive

3. **Communicate Risk**
   Professional stakeholders & public

4. **Options Identification**
   Identify measures

5. **Short-list Measures**
   Blue print for watercourse de-culverting, centralised database

6. **New Development**
   Catalyst for re-investment, develop outline drainage strategy
<table>
<thead>
<tr>
<th>Date</th>
<th>Available Details on Flood Incident</th>
<th>Location</th>
<th>Ref. on Map</th>
<th>Source of Flooding</th>
</tr>
</thead>
<tbody>
<tr>
<td>20th July 2007</td>
<td>Water flowing into and out of the canal during extreme rainfall event.</td>
<td>Stourbridge Lock 16 (confluence with Town Arm)</td>
<td>2</td>
<td>Canal Overtopping</td>
</tr>
<tr>
<td>20th July 2007</td>
<td>Water flowing out of the canal during extreme rainfall event.</td>
<td>Delph Bottom Lock</td>
<td>3</td>
<td>Canal Overtopping</td>
</tr>
<tr>
<td>20th July 2007 / 12th September 2008 / 9th November 2008</td>
<td>Water flowing into the canal.</td>
<td>NAA*</td>
<td>1</td>
<td>Canal Overtopping</td>
</tr>
<tr>
<td>Probably September 2008</td>
<td>Erosion from the watercourse to the canal. For maintenance purposes, BW lowered one of their overflows, causing flooding to properties on Rushall Close.</td>
<td>Rushall Close</td>
<td>14</td>
<td>Canal Overtopping</td>
</tr>
<tr>
<td></td>
<td>This area may experience flooding due to trash / security screen blockage. EA maintenance regime here requires improvement.</td>
<td>NAA*</td>
<td>5</td>
<td>Culvert Blockage</td>
</tr>
<tr>
<td></td>
<td>Significant flooding, surface water runoff due to urban drainage capacity.</td>
<td>NAA*</td>
<td>4</td>
<td>Drainage system at capacity</td>
</tr>
<tr>
<td></td>
<td>A mine drainage system discharges here into a pool (Foots Pool) with no outlet. This has developed into a sizeable lake which causes water management problems. Capital works bid presented to Defra to resolve this.</td>
<td>NAA*</td>
<td>11</td>
<td>Drainage system at capacity</td>
</tr>
<tr>
<td></td>
<td>Issues related to tipping into the river.</td>
<td>NAA*</td>
<td>6</td>
<td>Fly-tipping</td>
</tr>
<tr>
<td>June 2007</td>
<td>Site currently being developed.</td>
<td>NAA*</td>
<td>12</td>
<td>River Flooding</td>
</tr>
<tr>
<td>June 2007</td>
<td>Historic flooding. Balancing pools have been installed and have proved to be effective so far.</td>
<td>NAA*</td>
<td>7</td>
<td>River Flooding</td>
</tr>
<tr>
<td></td>
<td>Associated with bank undercutting.</td>
<td>NAA*</td>
<td>8</td>
<td>River Flooding</td>
</tr>
<tr>
<td></td>
<td>1 property flooded by runoff from hillside. Issue now resolved by drainage improvements.</td>
<td>NAA*</td>
<td>9</td>
<td>Surface Water Runoff</td>
</tr>
<tr>
<td></td>
<td>Flooding of gardens due to unsuitable ploughing / farming regimes.</td>
<td>NAA*</td>
<td>10</td>
<td>Surface Water Runoff</td>
</tr>
<tr>
<td></td>
<td>An inadequate culvert on the golf course causes short duration overland flow at times of heavy rainfall. Further development in the catchment would aggravate the problem.</td>
<td>Stourbridge Golf Course</td>
<td>15</td>
<td>Surface Water Runoff</td>
</tr>
<tr>
<td></td>
<td>An inadequate watercourse adversely affects surface water outfalls from adjacent development.</td>
<td>North West Sedgley</td>
<td>16</td>
<td>Surface Water Runoff</td>
</tr>
<tr>
<td></td>
<td>An inadequate watercourse adversely affects surface water outfalls from adjacent development and highways, causing surface flooding.</td>
<td>West Sedgley</td>
<td>17</td>
<td>Surface Water Runoff</td>
</tr>
<tr>
<td></td>
<td>Localised flooding of fields, but not very well reported as the area is unpopulated.</td>
<td>NAA*</td>
<td>Unknown</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Field flooding. Property flooding indicated by EA flood zone is unrealistic.</td>
<td>NAA*</td>
<td>Unknown</td>
<td></td>
</tr>
</tbody>
</table>

* NAA: No address available
<table>
<thead>
<tr>
<th>Date</th>
<th>Available Details on Flood Incident</th>
<th>Location</th>
<th>Ref. on Map</th>
<th>Source of Flooding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980s and 1990s</td>
<td>Major historical flooding associated with a railway culvert, now maintained as a high priority. No flood incident reported for the last 10 yrs. Sandbags, portable barriers, etc. are available to local residents.</td>
<td>Hamstead Brook</td>
<td>4</td>
<td>Culvert Blockage</td>
</tr>
<tr>
<td>Summer 2007</td>
<td>Only experiences minor flooding, except at the electricity sub-station (critical local infrastructure); major flood event due to culvert blockage. This culvert is now cleared on a monthly basis.</td>
<td>Electricity sub-station (Yew Tree Brook)</td>
<td>1</td>
<td>Culvert Blockage</td>
</tr>
<tr>
<td></td>
<td>Drains adjacent fields and motorway. The trash / security screen outlet at the start of the storage pools experienced blockage and overtopping. Now subject to weekly checking. Another culvert Grove Vale experiences blockage - cleared when reported.</td>
<td>Red House Park Brook</td>
<td>2</td>
<td>Culvert Blockage</td>
</tr>
<tr>
<td></td>
<td>Small urban catchment. 3 residential properties commonly at risk of flooding due to blockage of a pipe inlet during heavy storms. Requires weekly maintenance.</td>
<td>Spout House Lane Culvert</td>
<td>3</td>
<td>Culvert Blockage</td>
</tr>
<tr>
<td></td>
<td>In 2 locations, culverts trash / security screen experience blockages that cause flooding within the steep valley. It is also noted that the dam at the Dudley boundary on the Mouse Sweet Brook is of a poor standard.</td>
<td>Mouse Sweet Brook</td>
<td>10 &amp; 11</td>
<td>Culvert Blockage</td>
</tr>
<tr>
<td>Approximately 3 times a year</td>
<td>During heavy rains, manhole cover blows. Cause appears to be a blockage under or adjacent to a BW syphon. Maintenance of this syphon may prevent this problem.</td>
<td>Crystal Drive-Oldbury-Entrance of Cadbury depot</td>
<td>14</td>
<td>Drainage system at capacity</td>
</tr>
<tr>
<td>Summer 2007 and 28th July 2008</td>
<td>Internal foul flooding. Initially due to river, surface water and foul flooding. Improvements then made on highway drainage and storm water sewer to prevent back up from River Tame. 2nd occurrence attributed to maintenance regime of the Black Country Trunk Sewer.</td>
<td>23, 24 &amp; 25 Roway Lane</td>
<td>13</td>
<td>Drainage system at capacity</td>
</tr>
<tr>
<td></td>
<td>Flooding via manhole burst (vandalism rather than hydraulic factor) in the Beaconsfield Str. area. Extreme storms causing flooding at Cardigan Close (3-4 properties affected) and Clarks Lane.</td>
<td>Hobnail Brook</td>
<td>5</td>
<td>Drainage system at capacity</td>
</tr>
<tr>
<td></td>
<td>Large catchment with multiple drain feeds and significant highway contribution. Initially lack of capacity through motorway culvert. Led to £3M construction of an additional storm culvert. Problem largely alleviated (no major flooding during summer 2007).</td>
<td>Perncricket Lane (York Brook)</td>
<td>8</td>
<td>Drainage system at capacity</td>
</tr>
<tr>
<td></td>
<td>Costly flood event caused by poorly designed culvert under A4123.</td>
<td>White Heath Brook</td>
<td>9</td>
<td>Drainage system at capacity</td>
</tr>
<tr>
<td></td>
<td>Issue related to both highway drainage and sewer system.</td>
<td>Throne Road</td>
<td>12</td>
<td>Drainage system at capacity</td>
</tr>
<tr>
<td></td>
<td>Water level in the pool causes surcharging of surface water sewers discharging into it. Improvements to the foul sewerage system in the area have reduced the flood flows from overflow facilities. It is believed that the problem has been alleviated.</td>
<td>Millfields Pool, West Bromwich</td>
<td>15</td>
<td>Drainage system at capacity</td>
</tr>
<tr>
<td>Last 2 events in July 2008</td>
<td>Fed by surface water from local housing estate. Flood alleviation structures constructed in 2003 within golf course upstream of culvert entrance. Only 1 flood event recorded since (maintenance issues). Flood Warning telemetry operates at this site.</td>
<td>Brandhall Brook</td>
<td>7</td>
<td>River Flooding</td>
</tr>
<tr>
<td></td>
<td>Experiences regular flooding (1 in 1 or 1 in 2 yrs). No properties affected but adjacent road can become impracticable.</td>
<td>Hockley Brook</td>
<td>6</td>
<td>Surface Water Runoff</td>
</tr>
<tr>
<td></td>
<td>Road Flooding Incident - No details available.</td>
<td>39 locations reported</td>
<td>Unknown</td>
<td></td>
</tr>
</tbody>
</table>
## Available Details on Flood Incident

<table>
<thead>
<tr>
<th>Date</th>
<th>Available Details on Flood Incident</th>
<th>Location</th>
<th>Ref. on Map</th>
<th>Source of Flooding</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>Canal levels have caused leakage, generating flooding of gardens.</td>
<td>NAA*</td>
<td>4</td>
<td>Canal Overtopping</td>
</tr>
<tr>
<td>August 2008</td>
<td>Flooding from 2 overflows on the Wyrley Canal on to the upstream part of the Ford Brook.</td>
<td>Exact location unknown</td>
<td>18</td>
<td>Canal Overtopping</td>
</tr>
<tr>
<td>2007</td>
<td>Storm sewer blockage.</td>
<td>Lichfield Road</td>
<td>2</td>
<td>Culvert Blockage</td>
</tr>
<tr>
<td></td>
<td>Sewer overflow and Sneyd Brook flooding.</td>
<td>NAA*</td>
<td>9</td>
<td>Drainage system at capacity</td>
</tr>
<tr>
<td></td>
<td>Flooding due to pipe capacity issue.</td>
<td>Buchanan Avenue &amp; Arboretum</td>
<td>11</td>
<td>Drainage system at capacity</td>
</tr>
<tr>
<td>2007</td>
<td>Highway flooding due to inadequate sewerage.</td>
<td>NAA*</td>
<td>6</td>
<td>River Flooding</td>
</tr>
<tr>
<td>2000</td>
<td>River Tame burst its banks, resulting in flooded gardens.</td>
<td>NAA*</td>
<td>15</td>
<td>Drainage system at capacity</td>
</tr>
<tr>
<td>2007</td>
<td>Fluvial flood event from River Tame.</td>
<td>Bescot Crescent</td>
<td>16</td>
<td>Surface Water Runoff</td>
</tr>
<tr>
<td></td>
<td>Caravan park at risk of fluvial flooding.</td>
<td>NAA*</td>
<td>1</td>
<td>Surface Water Runoff</td>
</tr>
<tr>
<td></td>
<td>Cause appears to be a blockage under or adjacent to a BW syphon. Maintenance of this syphon may prevent this problem.</td>
<td>NAA*</td>
<td>3</td>
<td>Surface Water Runoff</td>
</tr>
<tr>
<td></td>
<td>Highway flooding due to drainage from adjacent farmland - Also potential canal breach.</td>
<td>NAA*</td>
<td>7</td>
<td>Surface Water Runoff</td>
</tr>
<tr>
<td></td>
<td>Flooding attributed to Highfields South Quarry.</td>
<td>NAA*</td>
<td>8</td>
<td>Surface Water Runoff</td>
</tr>
<tr>
<td></td>
<td>Surface water flood risk to scout hut from highway and allotment gardens.</td>
<td>Green Lane</td>
<td>10</td>
<td>Surface Water Runoff</td>
</tr>
<tr>
<td></td>
<td>Highway flooding due to runoff from adjacent fields.</td>
<td>Delves Green Road</td>
<td>12</td>
<td>Surface Water Runoff</td>
</tr>
<tr>
<td></td>
<td>Highway flooding due to runoff from adjacent fields.</td>
<td>Skip Lane</td>
<td>13</td>
<td>Surface Water Runoff</td>
</tr>
<tr>
<td></td>
<td>Highway flooding from Hospital Street.</td>
<td>Bloxwich Road / Proffit Street</td>
<td>14</td>
<td>Surface Water Runoff</td>
</tr>
<tr>
<td></td>
<td>Major flood incident - Cemetery flooded from highway runoff.</td>
<td>Kendricks Road</td>
<td>15</td>
<td>Surface Water Runoff</td>
</tr>
<tr>
<td>2007</td>
<td>Road Flooding Incident - No details available.</td>
<td>Longwood Lane</td>
<td>16</td>
<td>Unknown</td>
</tr>
<tr>
<td></td>
<td>Highway flooding. This is the lowest point in Walsall. Works currently being carried out by the Council, ST and Network Rail to sort this out via the installation of a sump pump.</td>
<td>Bridgeman Street</td>
<td>17</td>
<td>Unknown</td>
</tr>
<tr>
<td></td>
<td>Road Flooding Incident - No details available.</td>
<td>Wolverhampton Road West</td>
<td>18</td>
<td>Unknown</td>
</tr>
<tr>
<td></td>
<td>Road Flooding Incident - No details available.</td>
<td>M6 J10</td>
<td>19</td>
<td>Unknown</td>
</tr>
<tr>
<td>Date</td>
<td>Available Details on Flood Incident</td>
<td>Location</td>
<td>Ref. on Map</td>
<td>Source of Flooding</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-----------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------</td>
<td>-------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>20th July 2007</td>
<td>Water flowing into the canal, over cutting face from Wolverhampton race course area over 400m length.</td>
<td>NAA*</td>
<td>2</td>
<td>Canal Overtopping</td>
</tr>
<tr>
<td>20th July 2007</td>
<td>Water flowing into and out of the canal in the Marsh Lane area. It is unclear whether water was from canal or sewer system.</td>
<td>NAA*</td>
<td>3</td>
<td>Canal Overtopping</td>
</tr>
<tr>
<td>Between 1998 and 2000</td>
<td>Canal bank failure led to spill from the canal into the brook, which in turn went out of bank.</td>
<td>Wightwick Mill Farm (Smestow Brook)</td>
<td>6</td>
<td>Canal Overtopping</td>
</tr>
<tr>
<td>Summer 2007</td>
<td>First time reported as an issue: overflow from the Worcestershire Canal.</td>
<td>Clewley Drive (Pendeford)</td>
<td>28</td>
<td>Canal Overtopping</td>
</tr>
<tr>
<td>1997</td>
<td>Major flood event (rated as 1 in 100 year return period) led to court case. City Council was forced to remove screens that were installed at the downstream end of the culvert for safety reasons.</td>
<td>Racecourse (Smestow Brook)</td>
<td>5</td>
<td>Culvert Blockage</td>
</tr>
<tr>
<td></td>
<td>This area receives significant drainage inflows. trash / security screen blockage from woodland debris causes overland flow.</td>
<td>Black Brook Way Estate (WaterHead Brook)</td>
<td>10</td>
<td>Culvert Blockage</td>
</tr>
<tr>
<td>Around 1998</td>
<td>A combination of surface runoff and foul water backing up.</td>
<td>Warstones Crescent</td>
<td>12</td>
<td>Drainage system at capacity</td>
</tr>
<tr>
<td>Summer 2007</td>
<td>Long-standing issue: internal flooding of property due to blockage of gullies by tree leaves.</td>
<td>52 Marston Road (Blakenhall)</td>
<td>24</td>
<td>Drainage system at capacity</td>
</tr>
<tr>
<td>Summer 2007</td>
<td>Long-standing issue: tarmac exploded.</td>
<td>Oxley Moor Road (Oxley)</td>
<td>25</td>
<td>Drainage system at capacity</td>
</tr>
<tr>
<td>Summer 2007</td>
<td>First-time issue: internal flooding due to partial blockage of the sewer. Now sorted, ST removed a blockage.</td>
<td>Vulcan Road (Bilton)</td>
<td>26</td>
<td>Drainage system at capacity</td>
</tr>
<tr>
<td></td>
<td>Low lying area that experiences overflow from foul and surface water drain systems.</td>
<td>Penn Road &amp; Woodfield Avenue</td>
<td>13</td>
<td>Drainage system at capacity</td>
</tr>
<tr>
<td></td>
<td>Internal flooding due to works carried out at an old air-raid field, during which concrete was pumped down the sewer. Now sorted: some 150 metres of sewer full of concrete have been replaced.</td>
<td>Manor Street (Tettenhall)</td>
<td>27</td>
<td>Drainage system at capacity</td>
</tr>
<tr>
<td></td>
<td>Several minor events. 1 major event, due to tipping of garden waste leading to manhole burst. General flooding results from a combination of surface runoff and foul water backing up.</td>
<td>Pinfold Grove (Merryhill Brook)</td>
<td>4</td>
<td>Fly-tipping</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oxley Brook near the Worcestershire Canal</td>
<td>1</td>
<td>Fly-tipping</td>
</tr>
<tr>
<td>Early 1990s</td>
<td>Major rain event led to flooding of 40-50 houses. Evacuations were required. Enhanced channel maintenance regimes are now in place along the reach.</td>
<td>Halesworth Road (Penderford Brook)</td>
<td>8</td>
<td>River Flooding</td>
</tr>
<tr>
<td>Around 1998</td>
<td>The river here is undercutting and encroaching onto private properties.</td>
<td>Henwood Road (Smestow Brook)</td>
<td>7</td>
<td>River Flooding</td>
</tr>
<tr>
<td></td>
<td>The brook here is prone to overtopping during heavy rain. At this location, the Oxley Brook is 1.5 m above ground level, and thus is embanked, and the trash screen at the beginning of the culvert</td>
<td>Eccleshaw Avenue (Oxley Brook)</td>
<td>9</td>
<td>River Flooding</td>
</tr>
</tbody>
</table>
This area is low-lying relative to adjacent bank heights. Significant improvements have been made to the watercourse, but have yet to be tested against significant rainfall events.

<table>
<thead>
<tr>
<th>Date</th>
<th>Available Details on Flood Incident</th>
<th>Location</th>
<th>Ref. on Map</th>
<th>Source of Flooding</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>requires regular maintenance.</td>
<td>Cranmoor Road (Graisley Brook)</td>
<td>11</td>
<td>River Flooding</td>
</tr>
</tbody>
</table>
6.4 Surface Water Flood Risk across the Black Country

The heavily urbanised nature of the Black Country and its corresponding high level of impermeable surfaces, the extensive network of culverted rivers, and steep sided valleys, result in a high susceptibility to localised surface water flooding during periods of intense rainfall.

As emphasised in the register of historical flood incidents (see Table 6-3 above), there are many potential causes for surface water flooding in the Black Country. Furthermore, these flood sources are often interlinked, thus exacerbating surface water runoff. A simple analysis of past flood events using the SPR method is therefore not possible in most cases given the limited data collected by the Councils and the EA during a particular incident.

Figure 6-6 below shows examples of surface water flooding in Walsall MBC. It each case, it was not clear what caused the flooding.

During heavy rainfall events, overland flow and surface water runoff is caused by natural topographic gradients, but can also be generated by, or combine with:

- Highway drainage or sewer design capacity exceedance or unsuitable maintenance regime;
- Culvert blockage;
- High levels in the receiving watercourse preventing discharge from the drainage system;
- Fly-tipping;
- Canal bank failure / overtopping / maintenance works.

These aspects are discussed in more details in the following sections.

6.4.1 Brief Overview of Main River Drainage Patterns

6.4.1.1 Dudley MBC (Figure 6-1)

Dudley MBC includes the towns and urban areas of Dudley itself, Stourbridge, Halesowen, Kingswinford, Brierley Hill and Sedgley / Coseley. The borough lies on the Severn side of the Severn-Trent catchment. The River Stour runs from east to west through the southern end of the borough and its tributaries drain most of the borough (as well as parts of Sandwell and Wolverhampton), before joining the River Severn at Stourport. Only Coseley in the northeast corner of the borough drains to the Tame catchment. Generally, Dudley MBC is located on higher grounds, hence fluvial flooding is not a significant issue. However, a combination of river flooding and surface water flooding has been reported in July 2007 and September 2008 in the Halesowen area. Flooding was reportedly exacerbated by blockages of culverts associated with illegal dumping of rubbish. In November 2008, several properties were affected by flooding through a combination of surface water and a canal breach / overtopping of the adjacent British Waterways canal network which affected properties along Rushall Close in Wordsley.
6.4.1.2 Sandwell MBC (Figure 6-2)

Sandwell MBC is almost entirely urban. It is centred on West Bromwich and includes the towns of Wednesbury, Tipton and Oldbury. The borough lies on the east side of the River Severn catchment and is also drained northwards by the headwaters of the River Tame, which then flows from west to east along the border between Sandwell and Walsall. The borough lies at the upstream end of both River Severn and River Tame catchments. Fluvial flooding is therefore not critical in this area (reportedly, an assessment on the summer 2007 floods is available at the Council but could not be consulted for the purpose of this study).

6.4.1.3 Walsall MBC (Figure 6-3)

Walsall MBC includes the urban areas of Walsall, Brownhills, Aldridge, Bloxwich, Willenhall and Darlaston. The south, west and centre of the borough are heavily urbanised but there are a number of isolated rural pockets in the north and east. The borough almost entirely drains southwards towards the River Tame.

6.4.1.4 Wolverhampton CC (Figure 6-4)

The City of Wolverhampton occupies much of the borough (with the town of Bilston in the south west corner) and is heavily urbanised. It lies on the western side of the Birmingham plateau some 122 metres above sea level. Most of the borough lies in the headwaters of the Stour and Tame catchments (western and eastern parts, respectively), whilst the northern edge of the borough drains into the River Penk.

Wolverhampton was not significantly affected by floods during summer 2007, for reasons linked with its historical drainage infrastructure development, its natural contours and its location upstream of the country's primary river basins. Although June-July 2007 was very wet (approximately 312 mm, or 267% of 1961-1990 average), the most intense event on 20th July tracked down to the south and west of the Black Country, leaving the Black Country relatively unaffected.

Dudley, Sandwell and Wolverhampton receive very little drainage from adjacent boroughs, being located at the upper end of their catchments. Therefore these Councils need to be aware of the downstream impact that development will place on the river and drainage systems, as well as the corresponding downstream communities. This has been achieved, for instance in Wolverhampton, by providing underground storage tanks in strategic locations or artificial storage reservoirs (e.g. the one at the centre of the racecourse).

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Figure 6.6 - Examples of Surface Water Flood Incidents in Walsall MBC

A461 (Lichfield Road) - 15/07/2007 event

Bridgeman Street (Walsall) - Recurrent highway flooding

Walsall Arboretum - Children’s play area

17 Photos during wet conditions courtesy of Walsall MBC.
6.4.2 Culvert Blockages

There is nearly 17 km of Main Rivers and 88 km of Critical Ordinary Watercourses in culvert in the Black Country, which includes 131 trash screens and accounts for approximately 20% of all rivers. The Boroughs that present the highest ratio of culverted watercourses are Wolverhampton CC (almost 50 km for a total length of 71 km, i.e. 70% culverted) and Walsall MBC (14.5 km for a total length of 46.7 km, i.e. 30% culverted). Dudley MBC has the lowest ratio with 3.3 km of culverts over 56 km of ordinary watercourses for which it is the relevant operating authority.

The Black Country SFRA demonstrated that 12 of the 22 main culverts assessed have an adequate conveyance capacity (i.e. superior to a 1-in-100 year flow). This capacity has been assessed against the current level of development and does not include allowance for the planned future growth in the Black Country. In any case, flooding history across the sub-region shows that there always remains a potential risk of blockage that can result in localised flooding.

The most sensitive trash screen locations are generally well known due to the frequency of blockages. It has been reported that these sensitive trash screens are generally maintained more frequently (i.e. weekly / fortnightly, or after intense rainfall). However, there is great uncertainty as to the level of siltation within culverts.

Whilst the responsibility for the condition and maintenance of a culvert often lies with the riparian landowner or the owner of the culvert, in practical terms it is unlikely that they would undertake culvert maintenance. As a result, the Councils or the EA fill this role by undertaking some level of maintenance works on a number of culverts and trash screens. Based on data collected and site visits, Table 6-4 summarises the maintenance regimes applied to trash screens and drainage assets.

---

20 Photos during wet conditions courtesy of Walsall MBC.
<table>
<thead>
<tr>
<th>Organisations</th>
<th>Trash Screen (T/S) Maintenance</th>
<th>Gullies Maintenance</th>
<th>Sewer Maintenance</th>
<th>Emergency Response</th>
<th>Recommendations for Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dudley MBC</td>
<td>Maintenance contracted out.</td>
<td>This service was made independent from the Drainage Department in 2005 (highway maintenance depot).</td>
<td></td>
<td>A phone service exists (Dudley Council Plus) that filters and re-route calls.</td>
<td>Rationalise gullies maintenance regime on a risk-based approach.</td>
</tr>
<tr>
<td></td>
<td>56 km of ordinary watercourse (3.3 km culverted and some sections classified as critical) under DMB's responsibility. River Stour, sections of Mousesweet Brook and Illey Brook are designated as Main Rivers.</td>
<td>Before services were separated, maintenance regime was: - 2 to 3 times / yr for gullies on main roads; - 1 time / yr for gullies on side roads. Current gullies maintenance regime unknown.</td>
<td></td>
<td></td>
<td>Keep gullies database updated.</td>
</tr>
<tr>
<td></td>
<td>47 trash screens with risk-based approach: T/Ss are cleared every 3 months. Critical ones are also cleared after storm events or upon request (calls from residents). Selection is made based on historical knowledge.</td>
<td></td>
<td></td>
<td></td>
<td>Create reporting procedures between the Drainage Department and the Highway Maintenance Depot to share information.</td>
</tr>
<tr>
<td></td>
<td>Risk-based approach: - 8 critical trash screens are cleared weekly - 14 trash screens are cleared monthly Criteria is based on historical knowledge.</td>
<td>No details on maintenance regime. The Council owns the database of all gullies (location and type, but no information on discharge arrangements)</td>
<td></td>
<td></td>
<td>Estimate discharge point of all gullies.</td>
</tr>
<tr>
<td>Walsall MBC</td>
<td>- 39 km of ordinary watercourses (none of which are classified as critical) for which Walsall MBC is the relevant operating authority. Annual inspections. - 46 large bodies of water (volume undefined) Maintenance team was privatised on April 1st 2009. - 6 culverted watercourses totalling 7.8 km; - 3 tunnels totalling 6.7 km - 25 T/S.</td>
<td>Every gully cleared at least once a year but maintenance is generally reactive.</td>
<td></td>
<td>Not responsible.</td>
<td>Undertake risk-based gullies and trash screens maintenance programmes with a coherent route. Historical knowledge on critical areas should be used first in developing the program.</td>
</tr>
</tbody>
</table>

**Table 6-4 - Reported Drainage Asset Maintenance Regimes (including Ordinary Watercourses)**

- **Dudley MBC**
  - Maintenance contracted out.
  - 56 km of ordinary watercourse (3.3 km culverted and some sections classified as critical) under DMB's responsibility. River Stour, sections of Mousesweet Brook and Illey Brook are designated as Main Rivers.
  - 47 trash screens with risk-based approach: T/Ss are cleared every 3 months. Critical ones are also cleared after storm events or upon request (calls from residents). Selection is made based on historical knowledge.
  - Maintenance contracted out. This service was made independent from the Drainage Department in 2005 (highway maintenance depot).
  - Emergency Response: A phone service exists (Dudley Council Plus) that filters and re-route calls.
  - Recommendations for Improvement: Rationalise gullies maintenance regime on a risk-based approach.

- **Sandwell MBC**
  - Maintenance contracted out from 2006.
  - Risk-based approach: - 8 critical trash screens are cleared weekly - 14 trash screens are cleared monthly Criteria is based on historical knowledge.
  - Gullies Maintenance: Maintenance contracted out. The contractor clears gully pots and reports blockages in the connection pipe.
  - Emergency Response: Not responsible.
  - Recommendations for Improvement: Keep gullies database updated.

- **Walsall MBC**
  - - 39 km of ordinary watercourses (none of which are classified as critical) for which Walsall MBC is the relevant operating authority. Annual inspections. - 46 large bodies of water (volume undefined) Maintenance team was privatised on April 1st 2009. - 6 culverted watercourses totalling 7.8 km; - 3 tunnels totalling 6.7 km - 25 T/S.
  - Gullies Maintenance: Every gully cleared at least once a year but maintenance is generally reactive.
  - Emergency Response: Not responsible.
  - Recommendations for Improvement: Undertake risk-based gullies and trash screens maintenance programmes with a coherent route. Historical knowledge on critical areas should be used first in developing the program.
## Black Country Water Cycle Study and Scoping Surface Water Management Plan

**Organisations**
- **Wolverhampton CC**
- **Severn Trent Water**

<table>
<thead>
<tr>
<th>Organisations</th>
<th>Trash Screen (T/S) Maintenance</th>
<th>Gullies Maintenance</th>
<th>Sewer Maintenance</th>
<th>Emergency Response</th>
<th>Recommendations for Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wolverhampton CC</td>
<td>Monthly T/S maintenance except on the Sneyd Brook (fortnightly). During heavy rain, reactive maintenance at pinch points and hot spots.</td>
<td>No database on highway gullies. The Council is in the process of geo-referencing all gullies. Discharge points will be estimated.</td>
<td></td>
<td></td>
<td>If not existing, develop a public phone service for residents to report blocked gullies or trash screens. This should help building up local knowledge on critical gullies for a risk-based maintenance regime.</td>
</tr>
<tr>
<td>37 Trash screens.</td>
<td>Risk-based maintenance regime: - fortnightly for sensitive T/Ss; - every month for less sensitive T/Ss; - upon demand (after heavy rains or when residents call).</td>
<td>All gullies are cleared at least once a year.</td>
<td></td>
<td>Not responsible.</td>
<td></td>
</tr>
</tbody>
</table>

**Gullies Maintenance**
- No database on highway gullies. The Council is in the process of geo-referencing all gullies. Discharge points will be estimated.

**Emergency Response**
- No information on how public can report drainage problem.

**Recommendations for Improvement**
- If not existing, develop a public phone service for residents to report blocked gullies or trash screens. This should help building up local knowledge on critical gullies for a risk-based maintenance regime.

**Wolverhampton CC**
- No database on highway gullies. The Council is in the process of geo-referencing all gullies. Discharge points will be estimated.
- Certain "strategic" watercourses that are known to pose a high risk of property flooding if they become blocked are checked and maintained by the Council's contractor on a regular basis. No further information could be obtained regarding those watercourses.
- There is a 24 hour phone number and a direct line to Drainage Engineer's (Ian Law) mobile phone, to report flooding from the public highway and blocked road gullies or gratings.

**Severn Trent Water**
- Not responsible. Not responsible. Not communicated
- Communicate maintenance plans and works to Highways Authorities.

**Trash Screen (T/S) Maintenance**
- Monthly T/S maintenance except on the Sneyd Brook (fortnightly). During heavy rain, reactive maintenance at pinch points and hot spots.
- T/Ss at Ford Brook, Bentley Canal and River Tame tunnels are cleared by the EA.
6.4.3 Interactions with River Network

A surge in river water levels can combine with topographic gradients to cause surface water flooding in remote locations, or prevent discharge from sewer outlets in the receiving watercourse, leading to sewer flooding upstream in the sewer network. Therefore culvert blockage and fly-tipping are also a contributing factor of surface water flooding, by causing river water levels to rise.

For instance, during summer 2007, some locations along the upper reach of the Stour and Illey Brook experienced significant flooding caused by a combination of high river levels and culvert capacity problems\(^22\).

There are a small number of issues related to fly-tipping. The illegal dumping of rubbish into watercourses has the potential to cause serious flooding incidents. It is therefore recommended that the EA and the Councils work together to raise awareness amongst local residents regarding the flood risk related to blockages resulting from fly-tipping.

6.4.4 Canal Overtopping

Some of the reported flood incidents (see Table 6-3) are linked with canal overtopping. British Waterways owns and operates a dense canal network in the Black Country. Planned maintenance works are primarily targeted to weirs and lock gates, and to a lesser extent to individual dredging. A significant proportion of the revenue maintenance budget is earmarked for reactive maintenance\(^23\).

There is an interaction between several of the watercourses and canals in the Black Country. During heavy rainfall events, canals can pick up excess river water, which causes overtopping and flooding of adjacent fields and properties.

For example, a major breach of the Stourbridge Canal between Middle Bridge and Wordsley Aqueduct occurred on September 7th 2008, at the point of least resistance on an elevated embankment approximately 50 feet above the river Stour, near the site of a breach in the 1970’s (not referenced on the maps as the site is just outside the administrative boundary). Over two miles of towpath and bank between Lenton Chain and Stourton Locks was swept away causing flooding of an adjacent field. This completely drained the pounds to the River Stour, including the Stourbridge Town Arm (loss of 65 Megalitres). A total of 35 boats were grounded. This breach occurred as a result of a surge in canal water levels, caused by the collection of excess river water at Wordsley Aqueduct and by the River Stour overflowing in the Stourbridge Town Arm terminus and followed intense rainfall over 6-7th September 2008. BW quickly restored navigation from the Dudley canal, via Delph Locks and Wordsley Junction into the Town Arm.

\(^23\) Interview with British Waterways Asset Manager, 30th March 2009.
The canal network also receives water from many industries that connect (sometimes without consent) to the canal network. An agreement between BW and ST to identify all surface water discharges exists, but is understood to only partially report all connections.

It has been reported that canals have also caused surface water flooding through leakages or maintenance works (e.g. those requiring the lowering of overflows).

It is recommended that BW is included as a formal partner in the SWMP. This would allow BW to share information on planned maintenance and water levels during intense rainfall (BW owns a SCADA system that reports water levels to a central board), and help clarify discharge rights into the canal network.

6.4.5 Conclusions

Data analyses and site visits out have highlighted the localised, scattered and interlinked nature of flood incidents associated with surface water runoff across the Black Country. It is therefore difficult at this stage to recommend specific areas where investments in significant drainage schemes may be required or best utilised.

As these incidents are often due to culvert blockage or drainage capacity exceedance, future investments should rather focus on the following.

- **Undertaking an Outline SWMP (short-term):** Now that the SWMP Phase 1 “Preparation” stage is completed, we recommend the commencement of the Risk Assessment stage (Outline SWMP, Stage 2). This is based on level of existing surface water flood risk, the degree of interaction between flood sources and pathways and the proposed level of new development. An identification and selection of areas prone to surface water flood risk, based on detailed topography (LiDAR data) should be carried out using numerical modelling techniques. Please refer to Section 6.8 for more detailed information on modelling requirements for the Black Country.
• **Enhanced trash screens and gullies maintenance (short-term):** In most parts of the Black Country, maintenance works are undertaken following a risk-based methodology, drawing upon local knowledge. This approach should be formalised and enhanced through the permanent collection of additional information (e.g. residents issues/complaints register, systematic reporting of blocked gullies during clearing works).

• **Improving asset management and ensuring knowledge transfer through the development of a drainage assets database for the four Boroughs (short-term):** There are potentially significant amounts of local knowledge at the Councils that may be lost if not archived, shared and updated. It may be possible to utilise the Environment Agency’s National Coastal Flood Defence Database (NFCDD) as a platform for the Councils to upload their drainage and ordinary watercourse assets.

• **Creating opportunities to alleviate Surface Water Flood Risk through re-development (short to medium-term):** This could be achieved through close coordination between Developers and the Councils' Drainage Engineers in the shaping of the overall drainage layout (impact of development proposal on maintenance regimes, suitability of proposed drainage techniques, etc.). This would ensure that Local Planning Policies (SPDs and DPDs) regarding surface water runoff management, use of SUDS and the opening up of culverted watercourses are fully considered.

• **Managing flood risk better and improving the environment by naturalising the river system (medium to long-term):** Opportunities to undertake de-culverting of watercourses should be sought as development proposals come forward. This supports the principals of ‘Making Space for Water’ (MSfW) which is part of Defra's holistic approach to water management and encourages a greater use of the spatial planning system for sustainable water management. Consideration should be given at this stage to the use of Section 106 agreements.

### 6.5 Groundwater Flood Risk across the Black Country – Preliminary Analysis

#### 6.5.1 Origins of Groundwater Flooding

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

When the groundwater table rises to the surface causing groundwater flooding, basements can flood, buried services may be damaged, and storm sewers may become ineffective, exacerbating the risk of surface water flooding. Groundwater flooding can also lead to the inundation of farmland, roads, commercial, residential and amenity areas.
In the Black Country area it is thought that groundwater flooding may occur from:

- Sustained heavy rainfall causing the water table to rise over a short period of time;
- Continuing rebound of groundwater levels following a significant reduction in industrial abstraction from aquifers underlying the district over the last 40 years; and
- Groundwater discharge at disused mine shafts.

### 6.5.2 Groundwater Flooding Assessment Methodology

The methodology that should be used to determine the potential for groundwater flooding is described within this section. It is anticipated that the majority of activities and reporting will be carried out as part of an Outline (Stage 2) study, although some of the data has been collated as part of the current scoping phase.

#### 6.5.2.1 A) Groundwater Flooding resulting from a rise in the water table

In order to determine the risk of groundwater flooding from sustained heavy rainfall or rebound of groundwater levels, it is necessary to make a comparison between groundwater levels and ground level. For this purpose, the collection of the following information is necessary:

- Knowledge of the local solid and superficial geology and hydrogeology;
- Ground level data;
- Groundwater level data;
- Data for known groundwater flooding events; and
- Details of current and historic abstractions.

Knowledge of the geology and hydrogeology of the area will indicate those areas at risk from groundwater flooding. This type of flooding is associated with aquifers, which are hydrogeological units that allow groundwater movement. In addition, it is important to understand the relationship between adjacent hydrogeological units, as an aquifer may be confined by a surface aquitard, removing the potential for groundwater flooding (aquitards do not allow significant groundwater movement).

Groundwater level data for the aquifers should be examined to give the highest likely groundwater levels for comparison against ground level. If the highest likely groundwater level is close to ground level, then the potential for groundwater flooding will be high. Groundwater level data can be obtained for observation boreholes and/or from available piezometric maps. Groundwater flooding problems can also be identified from records of known groundwater flooding events held by the EA or Councils. However, care is needed as the source of flooding is not always obvious and can therefore be misreported.

Finally, it is important to consider the influence of historic abstractions and planned future abstraction. When there is a decline in abstraction, groundwater levels can recover, thereby reducing the depth to groundwater and leading to an increased risk of groundwater flooding.
6.5.2.2 B) Groundwater Flooding resulting from mine shaft discharge

The discharge of groundwater from mine shafts is another potential cause of groundwater flooding. The mechanism is very similar to that described above in A), although the effect is man-made. It is possible for mine shafts to cut through a number of hydrogeological units allowing the water table within deeper confined units to reach the ground surface, discharging as a groundwater spring.

In order to determine the risk of groundwater flooding from this mechanism, a survey to identify the location of disused mine shafts and associated groundwater discharges is required.

6.5.3 Preliminary Data Collection and Data Gaps

6.5.3.1 Topographic Data

Topographic data for the Black Country was obtained from Sandwell MBC in the form of archived LiDAR data (1 m horizontal, 0.15 m vertical resolution). This data is sufficient for completing a more detailed SWMP.

6.5.3.2 Geological Information

Information on solid and superficial geology in the Black Country was obtained from the British Geological Survey (BGS) in digital format and is presented in Figures 6-9 and 6-10. The solid geology comprises Carboniferous, Permian and Sherwood strata (Figure 6-9). These strata reflect a large variety of origins and consequently the rocks present widely varying lithological features and hydraulic properties. The superficial geology consists of Alluvium and River Terrace Deposits associated with surface watercourses, and Glaciofluvial Deposits and Till covering wider tracks of land.

It would be advisable to obtain geological borehole logs for the construction of a number of geological cross-sections. These will allow an improved conceptual understanding of the hydrogeological system.

6.5.3.3 Groundwater Level Data

Groundwater level data for the Black Country was requested from the EA. Data was only returned for one observation borehole; Nuttalls Farm observation borehole (NGR: SK 0665 0111) to the northeast of the study area. The majority of the Black Country area is underlain by minor aquifers, consisting mainly of the Carboniferous Coal Measures. These minor aquifers can generally support small local groundwater abstractions, but not large scale public supply abstractions. As a result of this, little groundwater monitoring is undertaken in this area by the EA or Water Companies. It is unlikely that accurate piezometric maps (groundwater level contours) will be derived for minor aquifers within the Black Country area. However, additional groundwater level information could be obtained from the BGS borehole database and mapped spring locations will indicate points where the groundwater table intersects ground level.

The western and eastern fringes of the Black Country area overlie the Permian and Sherwood Sandstones, which is classified as a major aquifer. The Nuttalls observation borehole penetrates and monitors this aquifer. In addition, numerical groundwater models have been produced for this aquifer. Therefore groundwater level data are more readily available for this major aquifer.
and piezometric maps indicating peak groundwater levels should be produced to assess the risk of groundwater flooding.

6.5.3.4 **Groundwater Abstraction Points and Historic Abstraction Data**

Historic abstraction data aids the identification of zones where abstraction may have been significantly reduced, potentially causing a rise in groundwater levels and therefore increasing the risk of groundwater flooding.

The locations of public water supply groundwater sources and their associated Source Protection Zones (SPZ) were obtained from the EA and these are shown in Figure 4.3. The public water supply groundwater sources are mainly located on the outcrop of the Sherwood Sandstone major aquifer, on the western and eastern fringes of the Black Country area. These abstraction sources are operated by SSW and ST (see section 4.4.1.2). In addition, a map showing the location of disused industrial abstractions as well as the historic abstraction quantities was obtained during site visits to WCC. Further details of historical abstractions are presented in Table 6-5 and in Figure 7-4.

It is recommended that in the event of a more detailed Phase 2 WCS study, any relationship between historic abstraction and reported groundwater flooding incidents should be determined. It would be advisable to obtain a comprehensive list of historic and current abstractions from the EA’s licence database and produce charts to display the abstraction history. The data to be collated include abstraction locations, the aquifers exploited, the time-series of abstraction and the date at which the licence was granted and/or revoked. This will help to establish any link between abstraction levels and groundwater flood events.

<table>
<thead>
<tr>
<th>Source of Abstraction</th>
<th>Volumes Abstracted (m$^3$ year$^{-1}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banks’ Brewery</td>
<td>Not known</td>
</tr>
<tr>
<td>Cullwell</td>
<td>Not known</td>
</tr>
<tr>
<td>West Midland Gas</td>
<td>318,225</td>
</tr>
<tr>
<td>British Rail</td>
<td>227,303</td>
</tr>
<tr>
<td>Courtoullos</td>
<td>2,298,949</td>
</tr>
<tr>
<td>Springfield Brewery</td>
<td>Not known</td>
</tr>
<tr>
<td>Star Aluminium</td>
<td>23,727</td>
</tr>
<tr>
<td>British Steel</td>
<td>300,259</td>
</tr>
<tr>
<td>Wolverhampton Corp. Boreholes (City wide)</td>
<td>113,651</td>
</tr>
</tbody>
</table>

6.5.4 **History of Groundwater Flooding in the Black Country**

As a starting point, evidence of historic groundwater flooding was collated for the study area. Historic events were only identified for WCC, although it is possible that Sandwell and Dudley Borough Councils have also experienced groundwater flooding. **N.B.** No site specific information on groundwater flooding was readily available with the exception of Wolverhampton which held detailed records on groundwater flooding incidents.

Anecdotal evidence of groundwater flooding was obtained from WCC (see Figures 6-4 and 7-4). There has been no reported occurrence since the early 1990’s, with most of the events dating back to 1993 and 1994.
During an interview with the Council's Drainage Engineer, it was stated that groundwater flooding in Sandwell Borough Council is seen as an increasing problem. However, the location of groundwater flooding events is difficult to determine, as most of the flood records for Sandwell do not indicate the potential cause of flooding. It is understood from the SFRA\textsuperscript{24} that the Council borders between Sandwell and Dudley have experienced high groundwater levels in the past.

Information regarding five mine shafts has been obtained from the EA; these are listed in Table 6-6. These structures discharge groundwater and are currently in use by BW to top up their canal system (20-30 Mld\textsuperscript{-1}). Therefore, groundwater flooding is not currently an issue at these mine shaft locations.

<table>
<thead>
<tr>
<th>Point</th>
<th>Name</th>
<th>Grid Reference (SO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Deepfield Shaft 2</td>
<td>9458 9496</td>
</tr>
<tr>
<td>D</td>
<td>Hawkins Shaft</td>
<td>9570 9549</td>
</tr>
<tr>
<td>B</td>
<td>Boat Dock Shaft</td>
<td>9565 9548</td>
</tr>
<tr>
<td>C</td>
<td>Deepfield Shaft 1</td>
<td>9458 9496</td>
</tr>
<tr>
<td>A</td>
<td>Bradley Shaft</td>
<td>9565 9518</td>
</tr>
</tbody>
</table>

6.5.5 Hydrogeological Investigations in the Black Country

Numerical groundwater models for the Sherwood Sandstone have been developed to the west and east of the Black Country. These models were developed to better understand the water resources available, but also in the case of the Birmingham area to the east, to assess the risks posed by rising groundwater levels following a decline in groundwater abstraction for local industry. In these modelled areas, groundwater level data are more readily available and piezometric maps have been produced.

6.5.5.1 The Birmingham Groundwater Model

The Birmingham Groundwater Model was developed by the Construction Industry Research and Information Association (CIRIA) in the early 1990’s to investigate the issue of rising groundwater levels in Birmingham and the engineering implications\textsuperscript{25}. The model was updated by the EA in 2001\textsuperscript{26} and there are plans to update the models in the near future. The EA undertook a monitoring programme to update groundwater level data for the model area in 2008. The data were obtained by Scott Wilson for a number of observation boreholes, including Constitution Hill Station (NGR 406700 287590) as presented in Figure 6-11. The hydrograph and preliminary discussion with the EA indicate that the rate of groundwater level rise has decreased since the last model update and it is unlikely that groundwater levels will rise further. However, the full set of groundwater level data should be obtained and compared with ground level data to ascertain the potential for groundwater flooding as part of an Outline (Stage 2) study.

\textsuperscript{24} Jacobs, The Black Country Strategic Flood Risk Assessment (SFRA), 2009.
6.5.5.2 The West Midlands Groundwater Model

The West Midlands Groundwater Model was developed in the late 1990's and includes the Stour Valley. It is recommended that during any Detailed WCS, piezometric maps and borehole groundwater level data should be acquired to assess the potential for groundwater flooding.

6.5.6 Recommendations

The current scoping study has identified that there is significant potential for groundwater flooding within the Black Country area. Anecdotal evidence suggests that historic groundwater flooding has occurred within the WCC administrative area. In addition, concerns regarding the potential for groundwater flooding in the Sandwell and Dudley Borough Council areas have also been raised. In light of this, it is recommended that the following activities are carried out as part of an Outline SWMP (Stage 2 study):

- Groundwater level data should be obtained from: water companies (observation and abstraction boreholes); the BGS Geindex database; the two numerical groundwater models; any studies undertaken by developers including EIA’s and water feature surveys; and studies carried out as part of mining activities. The location of groundwater springs should also be identified from examination of Ordnance Survey (OS) maps;

- Groundwater level data should then be compared with ground level data (LiDAR) to identify the minimum depth to groundwater table across the Black Country area;

- Historic abstraction data should be obtained from the EA and from water companies supplying the Black Country area. An ‘abstraction history’ can then be derived and compared with groundwater level trends and reported groundwater flooding events.
Water Resource Management Plans (WRMPs) should be acquired to identify planned future development of abstractions;

- Borehole logs should be collected and geological cross-sections constructed. The cross-sections in combination with groundwater level data will improve the conceptual understanding of the hydrogeological system; and

- As part of the next phase of a future SWMP, GIS maps should be produced with the aim of identifying areas at high, medium or low risk of groundwater flooding (based on available groundwater level data).

- Recommendations should be made to carry out further investigation in areas where data gaps do not allow confidence in the risk assessment. Recommendations should also be made for carrying out ‘flood risk’ groundwater level monitoring.

An additional recommendation that is outside of the SWMP process is that future Flood Risk Assessments (FRAs) should include a site-specific assessment of the potential risk posed by groundwater flooding. The detailed SWMP can be used as a screening tool to identify the need to address groundwater flooding within an FRA. However, the SWMP is not carried out at a resolution such that site specific issues are identified.

### 6.6 Sewer Flooding the Black Country

Sewer flooding is reported by Water Companies to the Ofwat (the water company regulator) Director General and is the fifth measure and hence known as the “DG5 Register”. Each year Ofwat require Water Companies to report on the current number of properties in their areas at risk of sewer flooding.

As of 25 August 2009, the only data we have only received from Severn Trent Water is the DG5 Register. This is the same data set Severn Trent provided to the Black Country Councils for the production of the Level 1 SFRA.

The current lack of a detailed Severn Trent sewer model presents a challenge in developing a shared understanding of all sources of flood risk. As an interim measure, the Severn Trent DG Register to a 5-digit post code level of detail could be useful in understanding where the network surcharges and identifying individual properties at risk from sewer flooding. Obtaining these data sets (Detailed sewer model and DG5 register) from ST would be central to a future Outline SWMP. It is recommended that this data is provided for any proposed future SWMP or detailed WCS (also see Section 6.8.1).
6.7 Land Contamination

Land contamination is one of the many criteria that drive spatial planning choices relating to where developments should go. In the case of the Black Country, land contamination issues are expected to be a critical driver in the selection and localisation of new developments and SUDS.

6.7.1 Local Context and Legal Framework

More than 200 years of intensive mineral extraction and other industrial activities have left coalfield-related residual problems throughout the Black Country. This not only results from relatively shallow coal extraction, or limestone, ironstone and clay mining (all generating chronic instability), but also from mine drainage channels, abandoned subsided canal beds, in-filled marl pits and sand workings that give rise to specific problems. Some of the more common substances encountered include arsenic, heavy metals (such as lead and mercury), oils and tars, solvents, acids and gases such as methane and hydrogen sulphide associated with the degradation of wastes. This legacy presents special difficulties for re-developers, in particular where the original surface now lies beneath fill contaminated by industrial residues.

Land Contamination issues are managed by the Environmental Protection Act 1990 Part IIA, as amended by the Environment Act 1995, which was introduced by the Government to tackle the legacy of land contamination created by historic land uses. Under this legislation, the legal definition of contaminated land is as follows:

"Any area which appears to the local authority to be in such a condition, by reason of substances in, on or under the land that:

- significant harm is being caused, or there is a significant possibility of such harm being caused, or
- pollution of controlled waters is being or is likely to be caused."

Consequently, surface waters, drinking water abstractions and groundwater, collectively known as “controlled waters”, are all specified receptors under Part IIA of the Environmental Protection Act 1990. Other regulatory regimes relevant to the protection of controlled waters include:

- **Water Resources Act 1991**: Empowers the EA to issue a "Works Notice" requiring remediation of controlled waters where pollution is demonstrated or suspected.
- **Groundwater Regulations 1998**: Requires authorisation for the disposal of List I or List II substances, and describes procedures for prohibiting or regulating activities on land that pose a threat to groundwater from List I/II substances.

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27 Section 72 A (2) Part IIA of the Environmental Protection Act 1990.
Under Part II of the EPA 1990, the mandatory duties for Local Authorities include:

1. To cause their area to be inspected for contaminated land (and to this end produce and publish a written inspection strategy);

2. To determine whether any particular site meets the statutory definition of Contaminated Land;

3. To act as the enforcing authority for all Contaminated Land unless the land is a Special Site where it is then the responsibility of the EA;

4. To maintain a public register in relation to its activities associated with the regime.

On the other hand, the EA is responsible for the protection of controlled waters (Water Resources Act 1991 and Water Industry Act 1991), and during development, as a Statutory consultee to advise on pollution of controlled waters and waste management.

A summary of findings related to the current situation of each Borough with regards to land contamination is presented below.

6.7.2 Dudley

No land or property within the Borough of Dudley is currently designated as "contaminated land" as defined under Part II of the EPA 1990 and as such there are no entries in the public register. However, the nature of the borough's industrial past (built upon its mineral wealth of coal, ironstone, limestone, fireclay and sand) has generated waste materials that were spread across large areas in spoil heaps and refuse tips. The resulting widespread distribution of derelict and contaminated land needs to be recognised and treated as part of the regeneration of the Borough, especially considering that many industrial sites still remain in operation today and even now land contamination may arise from leaks and spillages.

6.7.3 Sandwell

Sandwell MBC has published its Contaminated Land Strategy in July 2001 and this is currently being implemented. However, no information regarding the number of sites potentially classified as "contaminated land" on the Public Register was available for this study.

6.7.4 Walsall

To date, Walsall MBC has not classified any sites as "contaminated land", in accordance with Part II of the EPA 1990. However, this does not indicate that any parcel of land is uncontaminated, as a large proportion of the land in Walsall Council's area has been indeed contaminated to some degree by historic land uses. For instance, Slacky Lane and Bentley Mill Way, where toxic metal contaminated water from historical tipping discharges via old mine workings to the Rough Brook and the River Tame respectively, are examples of such sites where water quality impacts are detected many miles downstream. However, there is currently no record in the Public Register because:

- insufficient information about its condition is available, hence the need for a more detailed land contamination assessment at development stage, or
- it is not considered to present a hazard to land users or the environment.
The designation of any land is likely to change to reflect changes to its use or additional information about its condition becoming available.

6.7.5 Wolverhampton

So far, WCC has not declared any sites as "contaminated" under Part II of the EPA 1990. However, Wolverhampton is currently in the process of implementing its Contaminated Land Strategy (2008), which is a large piece of work that will take a number of years to complete. In any case, the decline and rationalisation of industry, particularly in the metal based manufacturing sector, left behind substantial areas of derelict land, much of it contaminated.

6.7.6 Preliminary Conclusions

As highlighted above, there is currently no site within the Black Country (with the exception of Sandwell MBC for which no information on possible land contamination was available) that is classified as "contaminated land" under the provisions of Part II of the EPA 1990 (as amended), despite the strong industrial heritage of this region. This may be due to various interpretations of the legal definition of "contaminated land", or simply to the fact that only a small proportion of the Black Country has been assessed so far (although all Contaminated Land Strategies aim at prioritising sites and targeting first those where land contamination is suspected). In any case, re-development in the Black Country will bring significant changes in land uses, and land contamination is likely to be a critical issue to be addressed as development proposals come forward.

However, re-development and regeneration within the Black Country can be an opportunity to characterise and clean up a significant amount of derelict and previously used sites while bringing it back into beneficial uses. This is Government’s preferred way of tackling historic land contamination as it generally results in quicker clean up of potential hazards, and is in line with the increasing pressure to reuse land which is affected by contamination rather than develop greenfield sites such as parks or woodland.

As development proposals are put forward, and especially when they consist in a change of land use, the Council should systematically investigate the history of the land to identify the likelihood of contamination being present that could affect sustainable water management and more generally users of the development, bearing in mind that the type of contamination can vary widely from site to site and is specific to the previous use.

Then, where contamination is present or suspected, Conditions should be attached to the Planning Permission, in order to require the investigation and clean up of the land before the development is brought into use. This would include a systematic site sensitivity assessment for the water environment (groundwater, surface water and artificial drainage systems). The EA has produced guidance documents on this particular subject28. Such characterisation of site sensitivity is likely to be required in the following cases, but not limited to:

- where investigations on historical land uses highlighted potential land contamination issues;
- where infiltration-based SUDS are planned; and

• where drainage components are underlain by major aquifers.

6.8 Proposed Approach and Methodology for Future Pluvial Modelling

6.8.1 Background

Historical flood records in the Black Country feature some key characteristics that rule out simple, easily defined and targeted modelling approaches:

• **Scattered Flooding Incidents**: Spread over areas that cover a variety of land uses. No single "hot spot" with a significant concentration of drainage issues could be identified.

• **Flooding from All Sources**: The industrial history and the geology of the Black Country have created favourable conditions for all sources of flooding to potentially occur:
  - a significant proportion of the river network is culverted, making it vulnerable to non-predictable surface water flooding at trash screens and culvert locations (more than 130 locations throughout the Black Country);
  - the rather impermeable superficial geology over the coal measures increases the proportion of surface water runoff;
  - the halt in significant industrial water abstractions has increased the risk of groundwater flooding through rising of groundwater levels;
  - the study area is located in an area that includes an extensive canal network, whose interface with the river network and maintenance may affect other water bodies.

• **Interlinked Sources of Flooding**: Records of flooding events across the Black Country have demonstrated that a particular incident rarely results from a single trigger event/failure which could be described by a straightforward SPR model, but rather from a combination of interactions between river, canal, overland flow and sewer systems. Typical interactions observed throughout the flooding history of the Black Country include:
  - sewer flooding (manhole exceedance or internal household flooding) due to high levels in the receiving watercourse that prevent discharge from the sewer network;
  - sewer flooding due to exceeded sewer capacity or poor maintenance can combine with overland flow from adjacent areas to generate surface water flooding;
  - maintenance works carried out on the canal network (following the lowering of an overflow for instance) or exceeded capacity that cause overtopping and surface runoff;
  - potential for rivers eroding canal embankments, generating canal bank failure;
  - general ponding due to topographic depressions (train underpass, highways underpass, etc.).
6.8.2 **Objectives**

River flooding modelling across the Black Country has enabled the definition (and in some cases the refinement) of Flood Zones that help identify critical areas and infrastructures at risk of fluvial flooding. Similarly, simple calculations to check culverts capacity have led to identify problems areas, for example the Walsall Tunnel.

The polycentric and interlinked nature of flood incidents has prevented the clear identification of specific areas at risk. It is recommended that a high-level, borough or multi-borough wide surface water model therefore should be needs to be built based on the LiDAR data made available in the framework of this project. This would help to identify and prioritise areas at risk of surface water flooding. Records of flooding incidents are expected to provide valuable information by confirming the vulnerability of selected areas, which then could be targeted for further and more detailed modelling.

As a possible first step, the EA's Surface Water Susceptibility Maps\(^\text{29}\), now available directly to LPA’s, could provide, when combined with flooding records, an initial indication of areas susceptible to surface water flooding. However, there are significant limitations with these maps and the results could only be used to inform the location of more detailed pluvial modelling. The EA has undertaken broad scale surface water mapping using a simplified method that excludes urban sewerage and drainage systems, excludes buildings, and uses a single rainfall event. The mapping is intended for use by Local Resilience Forums (LRFs) and to inform emergency planning.

A reliable urban flood model requires a realistic representation of both urban land uses and elevations. In particular, rainfall-runoff modelling has to be implemented in both the "major system" (comprising watercourses, ground depressions, roads and footpaths) and the "minor system" (underground sewer network), as interactions between these two systems can play a significant role in the occurrence of flooding throughout the storm event. Similarly, the identification of critical areas calls for a reliable representation of surface retention storage, flow paths and volumes conveyed.

These objectives will not be achieved through the EA's broad scale Surface Water Susceptibility Maps (SWSM) that show the following limitations:

- The mapping does not show the interface between the surface water network, the sewer systems, the canal network and the watercourses;
- It does not show the susceptibility of individual properties to surface water flooding;
- The mapping has significant limitations for use in flat catchments; and
- It does not show the mechanism of flooding and does not quantify surface water flooding.

The intention of these maps being to provide the EA and Defra with a national scale of surface water flood risk mapping, similar in accuracy to the Flood Zone maps, more detailed modelling will be needed in complex areas such as the Black Country.

\(^{29}\) Environment Agency National Mapping, Areas Susceptible to Surface Water Flooding.
6.8.3 2D versus 1D Overland Flow Routing

Extreme flood events during which flows are not confined to streets/road profiles are more realistically represented by 2D models, as treatment of other urban structures (buildings, etc.) is more exact. However, 2D models require a higher level of spatial detail and much shorter time steps than 1D models. Their computational requirements therefore make it impracticable (in terms of time and cost) to implement them on wide areas like the entire Black Country.

This raises the dual issue of both the scope and the spatial extent of further surface water flood risk modelling in the Black Country. Whilst being a powerful tool for assessing surface water flood risk, modelling is still an evolving technique for which a site tailored cost/benefit compromise should be established.

- **Scope:** there are relatively low-cost but broad and approximate approaches (topographic index analysis / 2D overland routing of a spatially uniform rainfall event), and more time-consuming / expensive, but also more complex and accurate techniques (decoupled/coupled sewer model with 1D/2D overland routing). A relevant modelling approach should take into account:
  - the end user(s) (EA, LPAs, general public, etc.), their respective legal duties, areas of concerns and expectations;
  - the nature of flooding issues in the Black Country;
  - the required type of modelled outputs: from a simple sub-catchments / overland flow paths and ponding areas delineation, to the calculation of flood depths and velocities at a ward level.

- **Spatial Extent:** the study area (four Borough Councils) covers approximately 36,000 ha, and the total area covered by all Development Corridors adds up to 8,800 ha. This order of magnitude is better dealt with initially by simple and broad modelling approaches. Conversely, detailed modelling is more adapted to specific, identified critical areas of not more than a few hundred hectares.

6.8.4 Recommendations

A number of options are available for the four Borough Councils to consider, and these are summarised in Figure 6.12. All these modelling options should also consider the outputs provided in the SWSM, for which an assessment specific to the Black Country should be undertaken. This assessment could include, but not be limited to:

- **Quality assessment:**
  - comparison of predicted flooded areas with historical flooding;
  - comparison of predicted flooded areas with Flood Zones maps;
  - broad-scale comparison of predicted main ponding areas with local topography; and
  - identification of significant historical flooding spots not highlighted in the maps as at risk from surface water flooding.

- **Severity assessment:** (An appreciation of the severity of surface water flood risk, as it is also likely to influence the need for more detailed modelling)
- type, location and number of key infrastructure at risk;
- total area experiencing low / intermediate / high depth of flooding; and
- proportion of this area located in the proposed Development Corridors.

![Decision tree for future Urban Pluvial Modelling Options Appraisal](image)

**Figure 6.12 - Decision tree for future Urban Pluvial Modelling Options Appraisal**

- **Option 1**: Given the target growth assigned to the Black Country and the predominant directions in current guidance and bills issued by government bodies (Defra's *Making Space for Water* and *Technical Guidance on Surface Water Management Plans*, the Pitt Review and the Draft Flood and Water Management Bill, etc.), this is not seen as a viable option.

- **Option 2**: Refined surface water modelling specifically targeting the Black Country area should be undertaken and checked against historical surface water flooding hot spots. Although still at a large scale, this modelling would define sub-catchment areas and preferential flow paths delineation based on LiDAR data, perhaps using a 2-D model and blanket rainfall approach.

- **Option 3**: A similar 2-D model and blanket rainfall approach and/or a detailed coupled 1D-2D network/surface water model could be implemented to specifically target Critical Drainage Areas which were thought accurately highlighted by the Surface Water Susceptibility Maps, thus allowing for a greater level of detail in input (sewer network / culverted watercourses) and output data (sub-catchments, preferential flow paths, ponding areas). This option is specifically designed to address, at a high level of planning, future surface water flood risk to and from the proposed Development Corridors. The area to be covered is still very large.
6.9 Blue Print for Improving Watercourses in the Black Country

6.9.1 Local Context

The total length of culverted Main Rivers and Critical Ordinary Watercourses in the Black Country adds up to approximately 105 km, which accounts for around 20% of all rivers. Wolverhampton has the highest rate of culverted sections, with 70% of the total river length being culverted. The majority of the river corridors throughout the Black Country are indeed characterised by substantial sections of heavily constrained watercourse in concrete channel/culvert or partially modified, straightened river channel. The river floodplains are also highly urbanised and many sites adjacent to these watercourses have been previously developed. However some important areas of green space remain.

Over time, the natural geomorphology, hydrology and ecology of the river has been significantly altered and its wider floodplain storage capacity in flooding events reduced. In addition, inadequate consideration has sometimes been given to the location, form and design quality of new development so that opportunities to ‘Make Space for Water’, improve recreational access to and along the watercourses, provide attractive riverside greenspaces, and enhance biodiversity, have sometimes been lost.

A more coordinated long term approach to river corridor enhancements is therefore needed, especially in the broader context of the need to adapt to likely future climate change impacts, managing associated flood risks and the need to maximise social, economic and environmental benefits from major regeneration initiatives in the area.
6.9.2 Legal Framework

The EA\textsuperscript{31} and SEPA\textsuperscript{32} now discourage culverting, particularly where this fully encloses a watercourse.

In particular, the EA’s Policy Statement declares that “The Agency is in general opposed to the culverting of watercourses because of the adverse ecological, flood defence and other effects that are likely to arise”, and that “wherever practicable the Agency will seek to have culverted watercourses restored to open channels”.

This policy is aimed at addressing the following detrimental effects on:

- Flood risk management: increased susceptibility to blockages, increased impact of flooding, loss of storage capacity;

\textsuperscript{32} SEPA Position Statement to support the implementation of the Water Environment (Controlled Activities) (Scotland) Regulations 2005: Culverting of Watercourses, December 2006.
Environmental features: interruption of the continuity of the river corridor, removal of river features (pools, earth banks, gravel, cobble, etc.) and their associated vegetation, invertebrate community and fish;

Pollution and effect on water quality: increased difficulties in detecting the origins of pollution and in monitoring water quality;

Difficulties in the repair, maintenance and replacement of culverts;

Other ancillary reasons: increased difficulties in providing for drainage connections, health and safety hazards, impact on recharge to groundwater.

6.9.3 De-culverting and the Water Framework Directive

Under the WFD, culverted watercourses are termed “Heavily Modified Water Bodies” (HMWB) as they have historically been physically modified to support various valuable social and economic benefits. In some cases these modifications cannot be removed without having a major negative effect on the social and economic benefits that these uses bring. Therefore the WFD aspires for HMWBs to meet the (lower) standard of “Good Ecological Potential” (GEP), rather than the “Good Ecological Status”. GEP standards recognise that a HMWB cannot achieve status associated with natural waterbodies, and instead define whether a HMWB is close to achieving its best possible condition, given underlying limitations.

The WFD provides a suitable framework for de-culverting and/or improving the ecological potential of existing culverts. In the particular context of the Black Country and its strong industrial heritage, the definition of a HMWB calls for a close examination of the reasons why watercourses were culverted and the benefits of restoring them where possible. This could be achieved as part of the River Basin Planning process under the WFD.

6.9.4 River Corridor Improvement Plan (Scoping-Level)

Some culverts have been opened up and watercourses restored throughout the UK. For instance, the Tame Walkway project was designed to improve the public's access to and knowledge of rivers; the Kingfisher Project (Burton-on-Trent, Staffordshire) is also an excellent example of successful partnership between the local community, Local Authorities and conservation organisations to carry out enhancement work to a river and improve local public interest.

In order to analyse and address the issue of river corridor improvement, the Scoping SWMP has conducted a high level assessment to establish the initial criteria for a 100-year sustainable blueprint for desired future character, appearance and condition of the river channel and its wider corridor a scoping-level River Corridor Improvement Plan.

The key objectives of the Plan are:

- Co-ordinate river improvements across the administrative boundaries of all four LPAs;
- To setback new development, thereby making space for water, allowing for more storage and a better opportunity for river maintenance;
- To re-naturalise the channel to provide biodiversity and landscape enhancement;
- To improve recreational access to the river and the public realm; and
• To stimulate regeneration, promote social inclusion and community identity.

Three key aspects must be considered for a successful implementation of a large-scale River Corridor Improvement Plan:

1. **Actively Identify De-culverting Opportunities**
   
   These can be developed within the following frameworks:
   
   • Regeneration proposals, particularly for "brownfield" sites;
   • Development of Programmes of Measures to enhance HMWBs under the WFD;
   • Local Authority flood maintenance planning;
   • Local Biodiversity Action Plans; and
   • Environmental Impact Assessments.

   In researching best practice examples elsewhere, SEPA\(^\text{33}\) has developed criteria and practical guidance when assessing culverting proposals. These criteria could in turn be used when determining a basis for de-culverting in the Black Country:
   
   • Culverts for transport crossings: “Closed culverts used for river crossings would normally only be justified for single track roads over small watercourses (<2 m in width). For all other crossings, the use of span bridges and bottomless arch structures should be pursued, where practicable”.
   • Culverts for land gain: “Enclosed culverts for land gain would normally only be justified for developments that carry with them over-riding public interest, provided no other practical option exists that would allow the watercourse to remain open”.

2. **Secure Funding**
   
   Sufficient financial resources are needed to improve the ecological potential of HMWBs (remediation or mitigation of the damaging impacts of existing culverts, especially on fully enclosed watercourses). Financial opportunities (such as Section 106 agreements) for de-culverting should primarily be sought within regeneration in the proposed Development Corridors.

3. **Ensure Cooperation and Support**
   
   De-culverting projects generally require the cooperation of many different parties:
   
   • Local Authorities and any private landowners;
   • Regulators;
   • users and community groups;
   • professionals involved in initial environmental assessment, planning, landscape architecture, river hydrology / hydromorphology, conservation and biodiversity and recreation and social dimensions; and
   • consultants and contractors.

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\(^{33}\) SEPA Position Statement to support the implementation of the Water Environment (Controlled Activities) (Scotland) Regulations 2005: Culverting of Watercourses, December 2006.
The flow chart in Figure 6.14 below has been developed and tailored to the Black Country. Its aim is to be used as a tool (or check list) for spatial planners working at LPAs in the Black Country to help flag up potential opportunities for de-culverting at an early stage in the planning process.

**Figure 6.14 – Suggested outline Blue Print for Improving River Corridors in the Black Country**
6.9.5 Challenges to Successful De-culverting

The following is a list of potential issues linked with de-culverting\(^{34}\) to consider before implementing a River Corridor Improvement Plan:

- De-culverting is generally an expensive process and assured funding for projects must be secured beforehand. De-culverting is therefore better suited to regeneration projects;
- Removing a culvert that previously constrained flows can increase downstream flood risk, hence hydraulic modelling is needed at design stage to ensure no adverse flood risks;
- Securing support and partnership can be a lengthy process;
- The land above culverted watercourses may already be heavily urbanised, to an extent that makes de-culverting unrealistic; and
- Newly opened watercourses may attract fly tipping and vandalism, with increased deposition of rubbish following floods where re-engineered channels become wide and shallow. The EA, local communities and authorities need to be fully engaged and involved in maintenance and awareness raising.

6.10 Tools for Information Sharing and Management of Drainage Assets

In order to (i) identify individual stakeholder responsibilities, (ii) clarify roles for future flood risk management in the Black Country, (iii) enable stakeholders to better monitor the performance of flood risk assets and (iv) provide the community with accurate information, we believe that a central drainage asset register should be established. This central database will also help enable the development of future integrated solutions that cross differing LA sectors (e.g., Development Control, Strategic Planning, Transportation & Drainage, Emergency Planning) as well as the administrative boundaries of key responsible organisations.

6.10.1 Identified Drainage Asset Issues

The following flood risk asset management issues were identified during site visits and interviews with Drainage Engineers from each Borough and discussions with representatives from BW and the EA:

- The fragmentation of responsibilities for flood risk management has led to a decentralisation of knowledge and the development of different databases, sometimes containing outdated information.
- There is no single point of contact for Emergency Planning during a flood event (e.g., Local Authority Highways Department for road flooding, ST for sewer flooding, EA for Main River flooding). This has led to the development of several independent databases on flood history, with different contents and formats, and no linkage between them for updating data.

There are differing asset performance standards (for repair and maintenance of flood risk assets) across the key flood risk stakeholders.

This has led to the following three problems:

1. There is a great uncertainty over who owns what asset;
2. Loss of integrated knowledge over the drainage network (gullies and sewers are dealt with by two different bodies) and coordination of drainage improvements; and
3. Inefficiencies in the resolution of flood events through a lack of coordination and cooperation, as it is rarely clear whose asset experienced failure.

### 6.10.2 Drainage Asset Register - Centralised Database

Given the issues highlighted above, it is considered that the creation of a Centralised Database (Figure 6.15) on drainage and river assets and flooding events (GIS format) should be considered for implementation in the Black Country or on an individual Council basis. This is in line with the draft Floods & Water Bill (April 2009) and Defra's Progress Report on the Government's Response to The Pitt Review\(^\text{35}\). In the particular context of the Black Country, this database would have a dual objective:

- To share asset information and knowledge (asset condition, asset location, asset age, asset owner, etc.);
- As a second objective, to resolve responsibility following flood event or asset failure. This objective is seen as essential to give real weight to this asset register and ensure collaboration from all stakeholders in its development and regular updating.

In order to simplify procedures and improve inter-agency communication, each identified stakeholder could designate a contact person responsible for the provision of data with a formerly agreed content, frequency and format. It is believed that this process could largely be systematised, thus reducing costs, through the production of automated weekly/monthly exports from each stakeholder’s database. As these databases often cover other aspects relevant to each organisation’s duties, the process of automated reports production aims at extracting the relevant information in a format common to each stakeholder. These reports would then feed the central database, owned and maintained by the four Black Country Boroughs, as the stakeholders responsible for local flood risk including the coordination of SWMPs. As an alternative, there exists the potential to utilise the Environment Agency’s National Flood and Coastal Defence Database (NFCDD) as a platform to record the location, condition and performance of Council owned drainage and ordinary watercourse assets. To this end, we recommend that this option is discussed with the EA in length as part of a future Outline or Detailed SWMP.

The likely causes and, in situations where asset failure is suspected, responsibilities for flood incidents, can be quickly investigated on a case-by-case basis, taking account of the most complete and up-to-date information (last gully/trash screens/sewer maintenance works carried out, sewer capacity and catchment at this location, water levels in the receiving watercourse, etc.

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The initial concept of this shared database was established within the framework of this project, through the identification of new historical incidents and the collection of additional information on past flood events (refer to Table 6-3). For the EA to successfully fulfill its strategic overview role, flood events indeed need to be reported in more detail, so as to improve the current understanding of the mechanisms involved in historical flood events and to build up knowledge for the future. In particular, the SPR analysis should be systematically applied when reporting flood incidents, to the best of the available knowledge. Similarly, it is seen as essential to mention the exact date of the reported flood event, as it will enable potential users to:

- assess the frequency of flood incidents at a particular location;
- assess likelihood of future occurrence, taking account of potential remediation works carried out in the meantime; and
- link any given flood incident with a rainfall event (return period, total rainfall depth, maximum intensity, etc.), as infrastructure failure is not necessarily the cause for flooding.

Figure 6.15 - Schematic Diagram of Centralised Drainage Database (for conceptual discussion purposes).
Flood risk generated as a result of any development is an important consideration with respect to the assessment of development area potential and current national planning policy with regards to flood risk management.

In areas where development runoff is likely to be discharged to a river system, it is important that new development does not increase the risk of flooding downstream by increasing runoff rates to greater than that of the runoff generated by existing land use. In addition, it is important that new development does not increase the risk of overland flow to adjoining development areas by increasing the amount of impermeable area.

In order to reduce runoff rates from developed sites to that of existing (and where possible to achieve "betterment"), PPS25 and its companion guidance recommend that Sustainable Drainage Systems (or techniques) are used, known collectively as SUDS. Development within the new Development Corridors will need to include for SUDS both at a site specific level but also a strategic scale level. In general, there are advantages to be gained to developing drainage strategies for site wide developments such that strategic scale options such as balancing ponds can be developed at lower overall cost, but also to:

- Strategically manage flood risk and surface water;
- Maximise green infrastructure linkage;
- Maximise ecological enhancement;
- Maximise water quality benefits from retention and filter type SUDS; and
- Contribute towards the point system for Code for Sustainable Homes grading.

Consideration of the potential SUDS options is a key consideration for this strategic WCS. The following Sections outline some of the key strategic considerations for SUDS implementation in the development areas, and it is recommended that any subsequent Detailed WCS study develops site wide strategic drainage plans for the development areas taken forward into the next planning stage.

### 7.1 The Surface Water Management Train

The EA and Defra currently suggest that the SUDS management train (as per the CIRIA SUDS manual) is applied when considering SUDS techniques to be adopted for new development. This lists the order in which different SUDS techniques should be considered for a site in terms of their requirement to mitigate against surface water and flood risk.

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The management train considers SUDS options which first "prevent" the generation of runoff i.e. green roofs, rainwater harvesting at the communal scale; followed by techniques which control runoff at the source, such as infiltration to ground through permeable paving; then followed sequentially by site and regional techniques. When considering disposal of attenuated surface water, Part H of the Building Regulations\(^{38}\) requires that the first choice of surface water disposal should be to discharge to infiltration systems where practicable. In development sites over 1 hectare the EA will usually seek that infiltration is the method of surface water disposal, if feasible, as the method mimics natural drainage methods.

A SUDS hierarchy should be followed looking at infiltration methods first, then attenuation techniques followed by discharge straight to the sewer. The last options to consider are hard engineered solutions such as attenuation tanks. Infiltration for developments can occur via individual house soakaways through to infiltration lagoons. Attenuation, as a second option, should be provided so the runoff post-development is, as a minimum, no higher than the pre-development (brownfield) runoff rates. The EA will usually have more restrictive requirements, with the runoff from a development site not exceeding the un-developed (greenfield) runoff rate.

In accordance with PPS25: Development and Flood Risk, Councils must consult the Environment Agency under the following circumstances:

- Development other than minor development is proposed in Flood Zones 2 or 3
- Development in Flood Zone 1 where there are critical drainage problems
- Any development exceeding 1 hectare in extent
- Development within 20m of the bank top of a main river
- Any culverting, operation or development which controls the flow of any river or stream.

A site specific Flood Risk Assessment (in accordance with Annex E of PPS25) should accompany a planning application where any of the above points apply.

All new developments will be expected to incorporate Sustainable Drainage Systems to reduce the risk of surface water flooding, both to the site in question and to the surrounding area. Where the potential for surface water flooding has been identified, Flood Risk Assessments FRA’s should ensure suitable Sustainable Drainage Systems (SUDS) techniques are incorporated as part of redevelopment and where possible attenuate surface water flows to equivalent greenfield rates. As a minimum requirement surface water flows should not exceed those of pre-development rates where greenfield rates are unachievable.

Table 7-1 lists the order in which different SUDS techniques should be considered for a site in terms of their considered mitigation against surface water and flood risk. SUDS techniques at the top of the hierarchy are preferable for their infiltration and runoff prevention benefits. The management train provided below also states the additional potential ecological and water quality benefits that could be achieved by employing the proposed SUDS techniques.

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Table 7-1 - SUDS Management Train (Surface Water and Flood Risk Mitigation) – adopted from CIRIA SUDS manual

<table>
<thead>
<tr>
<th>Management Train</th>
<th>Component</th>
<th>Description</th>
<th>Water Quantity</th>
<th>Water Quality</th>
<th>Amenity Biodiversity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevention</td>
<td>Green roofs</td>
<td>Layer of vegetation or gravel on roof areas providing absorption and storage.</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Prevention</td>
<td>Rainwater harvesting</td>
<td>Capturing and reusing rainwater for domestic or irrigation uses.</td>
<td>●</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Prevention</td>
<td>Geocellular or Modular building materials</td>
<td>Manufactured blocks/crates with a cellular network of voids that can store and attenuate stormwater underneath/surrounding buildings.</td>
<td>●</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Prevention</td>
<td>Permeable pavements</td>
<td>Infiltration through the surface into underlying layer.</td>
<td>●</td>
<td>●</td>
<td>○</td>
</tr>
<tr>
<td>Source</td>
<td>Attenuation Infrastructure</td>
<td>Large Diameter Pipes, Culverts and Tanks to store and attenuate stormwater from site</td>
<td>●</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Source</td>
<td>Filter drains</td>
<td>Drain filled with permeable material with a perforated pipe along the base.</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Source</td>
<td>Infiltration trenches</td>
<td>Similar to filter drains but allows infiltration through sides and base.</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Source</td>
<td>Soakaways</td>
<td>Underground structure used for store and infiltration.</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Source</td>
<td>Bio-retention areas</td>
<td>Vegetated areas used for treating runoff prior to discharge into receiving water or infiltration</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Source</td>
<td>Swales</td>
<td>Grassed depressions, provides temporary storage, conveyance, treatment and possibly infiltration.</td>
<td>●</td>
<td>●</td>
<td>○</td>
</tr>
<tr>
<td>Source</td>
<td>Sand filters</td>
<td>Provides treatment by filtering runoff through a filter media consisting of sand.</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Source</td>
<td>Basins (infiltration &amp; Detention)</td>
<td>Dry depressions outside of storm periods, provides temporary attenuation, treatment and possibly infiltration.</td>
<td>●</td>
<td>●</td>
<td>○</td>
</tr>
<tr>
<td>Site</td>
<td>Ponds</td>
<td>Designed to accommodate water at all times, provides attenuation, treatment and enhances site amenity value.</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Site</td>
<td>Wetland</td>
<td>Similar to ponds, but are designed to provide continuous flow through vegetation.</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>
7.1.1 Infiltration SUDS

Infiltration is a key factor in reducing runoff rates and volumes, as it reduces reliance on surface or engineered storage systems such as balancing ponds or storage tanks. Some infiltration SUDS have the additional benefit of being able to encourage habitat creation and water quality benefits. Natural infiltration by creation of open grassland landscaping (where land contamination is not an issue) should be encouraged, first for large developments to maximise natural runoff rate reduction, and second to encourage natural recharge of groundwater systems.

Green areas and open space should be maximised for large development areas where the soil and geology is sufficiently permeable to make it a feasible option. Infiltration can also be encouraged via managed SUDS techniques such as soakaways, swales or infiltration trenches. Given that parts of the study area are underlain by permeable geology, infiltration is a key consideration for new development in Black Country. Section 7.2 and Figures 7-1 to 7-4 give further technical guidance on the location and suitability of infiltration techniques in the Black Country.

Despite this, the Sherwood Sandstone Aquifer underlying the Black Country is considered a Major Aquifer used for public supply therefore due regard needs to be paid to protection of groundwater from pollution pathways that can be created by poorly managed or badly located infiltration SUDS, and as such, there may be restrictions on the types of infiltration SUDS systems permitted within developments.

Determination of infiltration sensitive areas is considered by reviewing soil type and geology via groundwater vulnerability maps, and catchment areas which feed public water supply sources via Source Protection Zone mapping.

Table 7-2 shows potential SUDS options taking permeability and SPZs into consideration.

7.1.2 Surface Water Runoff Attenuation

Once it is known which development areas and scenarios are being taken forward, and once more is known about the numbers of housing and likely layouts of the sites, it is recommended that the detailed requirements for different types of SUDS is undertaken in any subsequent Detailed WCS. At detailed stage however, the volume of attenuation to be provided (either by infiltration or by storage) can be calculated to give an idea of the scale of mitigation and costs that would be required in order to mitigate flood risk from the development.

Attenuation storage aims to limit the peak rate of runoff from the development to the receiving watercourse to the corresponding Greenfield runoff rate for a range of annual flow rate probabilities (100%, 33% and 1%). The outlet structure dictates the rate at which the attenuation volume will drain. Should balancing / retention ponds be selected as the preferred storage option, they should have a catchment of at least 5 hectares each\(^\text{39}\) and / or a reliable source of baseflow to be successful as an amenity.

## Table 7-2 - SUDS Options

<table>
<thead>
<tr>
<th>Soil Permeability</th>
<th>Source Protection Zone</th>
<th>Attenuation Systems</th>
<th>Combined Systems</th>
<th>Infiltration Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Green or Brown Roofs</td>
<td>Rainwater Harvesting and Water Butts</td>
<td>Geocellular/Modular Large Diameter Pipes, Culverts or Tanks</td>
</tr>
<tr>
<td>Low</td>
<td>SPZ 1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>SPZ 2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>SPZ 3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Medium</td>
<td>SPZ 1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>SPZ 2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>SPZ 3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>High</td>
<td>SPZ 1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>SPZ 2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>SPZ 3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

N.B. L = Lined (system)
7.2 Suitability of Infiltration Techniques in the Black Country – SUDS Maps

Geological data from the British Geological Society has been used to prepare high-level SUDS maps presented on Figures 7-1 to 7-4. These maps provide the evidence base at an early stage of planning to inform the future drainage strategies for each Development Corridor, but can also be used elsewhere to assess the feasibility of infiltration techniques for SUDS retrofitting.

7.2.1 Methodology

The drift and solid geology layers were plotted by rock types. Each rock type was allocated into two simplified permeability classifications (permeable or impermeable). Classifying the highly complex geology of the Black Country into two permeability categories inevitably leads to simplifications. These SUDS maps provide information on the gross feasibility of infiltration techniques rather than on the degree of permeability of the soil. Therefore, localised assessment surveys of the soil permeability within each Development Corridor are required to fully assess the suitability of infiltration SUDS, regardless of the geology. Also, localised infiltration assessments will allow laboratory analysis to determine the presence of contaminants in the soil.

Solid and drift geology has been superimposed to determine a simplified infiltration feasibility assessment in the six scenarios shown in Figure 7.5.

![Figure 7.5 – Results of Simplified Infiltration Feasibility Assessment](image)

7.2.2 Results

Soil permeability assessment forms an essential part of any drainage strategy, allowing assessment of the overall potential weight of source control components, and the identification of suitable areas for implementation. In this respect, the SUDS maps, although prepared at a high level, are likely to influence and shape final drainage layouts.

The areas delineated as "impermeable" on Figures 7-1 to 7-4 roughly follow the Coal Measures. Most of the Development Corridors are located within this area and consequently a significant proportion of land will not benefit from infiltration techniques due to insufficient soil permeability. Numerical results are presented in Table 7-3.
In Development Corridors 10 and 14 (Kingswinford and Halesowen) ground conditions are widely favourable to infiltration-based drainage techniques like soakaways or permeable pavings. In these areas, significant runoff attenuation may be achieved through source control SUDS, reducing the pressure on hard engineering solutions and other infrastructure requirements (sewer extensions and upgrades) and land and open space (extensive flood storage areas).

In most Development Corridors however, the mixed permeability means that infiltration SUDS will not be suitable as a corridor-wide drainage strategy.

For Development Corridors 4 (Wolverhampton-Bilston), 7 (Bloxwich-Walsall) and 16 (Coseley-Tipton), the future drainage strategy and attenuation is likely to rely heavily on storage. Where ground conditions do not permit infiltration, or where numerous small scale source control elements are not used, the volume of detention storage required at a site will indeed increase as very little to no runoff will be lost to ground and the major attenuation components then need to store the full volume of runoff.

Under the current scope, we have not undertaken a specific SUDS appraisal assessment for strategic town centres. However, a more detailed assessment of SUDS for the development corridors and centres should be considered as this will enable greater clarity for both Development Control Planners at the Councils as well as local Developers in the selection of SUDS.

In order for sustainable drainage to be most effective, a specific series of site tailored elements for the runoff to pass through should be implemented. A suitable Management Train (or SUDS Hierarchy) for the Black Country will combine source, site and regional control components. Flood attenuation ponds will often prove to be necessary to store large volumes of runoff, but SUDS elements should also be introduced at property-level or street-level to provide source control. The final selection of the most suitable SUDS system is likely to depend on the following four key-factors:

1. Hydrology of the area and the infiltration rate of the upper soil layers;
2. Groundwater Source Protection Zones and contaminated land;
3. Scale and drainage strategy for the catchment area;
4. Pollutants present in the runoff (which in turn depends on the catchment characteristics and land uses: residential, industrial, etc.).
Table 7-3 - Breakdown per Development Corridor of feasibility of infiltration-based drainage techniques, based on drift and solid geology.

<table>
<thead>
<tr>
<th>Development Corridor Number</th>
<th>Area (ha)</th>
<th>A – Scenarios 1 &amp; 3 Proportion of area where ground permeability is favourable to infiltration techniques</th>
<th>B – Scenarios 4 &amp; 5 Proportion of area where further investigation regarding drift thickness is required</th>
<th>C – Scenarios 2 &amp; 6 Proportion of area where ground permeability is not favourable to infiltration techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>99</td>
<td>22%</td>
<td>78%</td>
<td>0%</td>
</tr>
<tr>
<td>2</td>
<td>214</td>
<td>8%</td>
<td>64%</td>
<td>28%</td>
</tr>
<tr>
<td>3</td>
<td>88</td>
<td>6%</td>
<td>60%</td>
<td>34%</td>
</tr>
<tr>
<td>4</td>
<td>516</td>
<td>2%</td>
<td>17%</td>
<td>81%</td>
</tr>
<tr>
<td>5</td>
<td>191</td>
<td>5%</td>
<td>18%</td>
<td>76%</td>
</tr>
<tr>
<td>6</td>
<td>829</td>
<td>8%</td>
<td>43%</td>
<td>49%</td>
</tr>
<tr>
<td>7</td>
<td>697</td>
<td>0%</td>
<td>16%</td>
<td>84%</td>
</tr>
<tr>
<td>8</td>
<td>776</td>
<td>37%</td>
<td>30%</td>
<td>33%</td>
</tr>
<tr>
<td>9</td>
<td>819</td>
<td>72%</td>
<td>11%</td>
<td>17%</td>
</tr>
<tr>
<td>10</td>
<td>306</td>
<td>96%</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>11a</td>
<td>655</td>
<td>39%</td>
<td>0%</td>
<td>61%</td>
</tr>
<tr>
<td>11b</td>
<td>402</td>
<td>71%</td>
<td>10%</td>
<td>19%</td>
</tr>
<tr>
<td>12</td>
<td>1,333</td>
<td>29%</td>
<td>47%</td>
<td>24%</td>
</tr>
<tr>
<td>13</td>
<td>992</td>
<td>56%</td>
<td>14%</td>
<td>30%</td>
</tr>
<tr>
<td>14</td>
<td>193</td>
<td>98%</td>
<td>0%</td>
<td>2%</td>
</tr>
<tr>
<td>15</td>
<td>305</td>
<td>4%</td>
<td>37%</td>
<td>59%</td>
</tr>
<tr>
<td>16</td>
<td>386</td>
<td>1%</td>
<td>0%</td>
<td>99%</td>
</tr>
<tr>
<td>Total Development Corridors within Black Country</td>
<td>8,802</td>
<td>34%</td>
<td>24%</td>
<td>42%</td>
</tr>
</tbody>
</table>

Production of maps identifying areas of favourable infiltration drainage should be produced during the Outline SWMP.

7.2.3 Limitations

These SUDS maps consider suitability for infiltration techniques based on drift and solid geology only. Due to data gaps, contaminated land and areas with a water table close to ground level have not been considered, but would likely lead to further limitations regarding the use of infiltration-based drainage techniques.

Groundwater Source Protection Zones are also presented in Figure 4.3 and Figures 7-1 to 7-4 and need to be taken into account when preparing the Development Corridors' detailed drainage strategies. In the vicinity of a groundwater source, and depending on the soil permeability, the use of a number of SUDS components will be restricted (no soakaway can be located within a SPZ 1 for instance) and/or their design will have to adapted (primarily pond lining requirements). Please refer to Table 7-2 for further guidance on how the suitability of SUDS components relates to each SPZ.

Finally, the data provided in this chapter does not preclude the need for detailed, site-specific infiltration tests at development stage. Infiltration techniques may not be effective if the infiltration rate is below 10 mm hr⁻¹ for the upper soil layers.⁴⁰

7.2.4 Conclusion - Scope for Further Investigations

This work has highlighted several critical data gaps that have to be filled, should an overall Detailed Drainage Strategy be implemented throughout the Black Country or by individual Councils.

- **Land Contamination:**
  
The industrial heritage of the Black Country has left significant land contamination issues that have an impact upon water sustainable management. Even in areas where ground conditions may be favourable to infiltration techniques, land contamination needs to be systematically investigated to determine whether SUDS are suitable as this will restrict the range of available drainage options.

- **Groundwater Levels:**
  
Generally, where the groundwater table is less than 5 metres below the ground surface, there is very limited potential for the pollutants to be dispersed, absorbed or otherwise neutralised before they enter the groundwater. Therefore the depth to groundwater and in particular the *seasonal maximum* must be known. From this information, a detailed risk assessment can be determined. For shallow groundwater the risk assessment should be detailed. Only one borehole record was obtained from the EA for the purpose of this study. More borehole records are thus needed, in particular from ST and SSW.

- **Drift Thickness:**
  
Almost a quarter (see Table 7-3, column B) of the total proposed Development Corridors area is either covered by:

  - permeable superficial deposits underlain by impermeable bedrock (scenario 4)
  - impermeable superficial deposits underlain by permeable bedrock (scenario 5)

In both situations, infiltration techniques may still be possible, provided the drift thickness is proved to be deep enough (see Figure 7.6 overleaf) (scenario 4) or shallow enough (scenario 5). To this end, borehole logs can be retrieved from the BGS and analysed to assess the drift thickness. In any case, detailed geological surveys should be undertaken by developers as required, as part of the planning application process to define the most suitable SUDS options.

![Figure 7.6 – Results of Simplified Infiltration Feasibility Assessment](image-url)
**Consideration of SPZs:**

As shown in Figure 4.3 and Figures 7-1 to 7-4, some of the proposed Development Corridors lie within groundwater Source Protection Zones. Careful consideration of any proposed infiltration arrangements and/or any upstream treatment needs to be made to ensure that the requirements of the Groundwater Regulations 1998 to protect groundwater from pollution are complied with.

**Infiltration Tests:**

Localised surveys should be requested within the planning application submission along with the SUDS strategy.

### 7.3 Institutional Arrangements - SUDS Adoption and Maintenance

One of the key elements of the design of sustainable drainage systems is to ensure their long-term management and maintenance. The adoption and maintenance of SUDS features can be a task that is often overlooked in the early stages of the planning process. Section 2.2.5 of the National SUDS Working Group’s "Interim Code of Practice for Sustainable Drainage Systems" states the "Maintenance of SUDS differs from that for conventional systems, so it is important to allocate responsibility for the maintenance of SUDS early in discussion before planning approval for the development is given". It is therefore important that SUDS adoption and maintenance is given consideration during the Detailed WCS to ensure that developers and planners sign-up at an early stage to the proposed flood mitigation measures and drainage systems.

Problems may arise if SUDS are not well maintained and maintenance requirements for SUDS differ from those for conventional systems. Hence it is crucial that responsibilities for the maintenance of SUDS are allocated early in discussions before planning approval for each development is granted.

No legally binding obligation relating to the provision and maintenance of SUDS currently exists, as opposed to conventional foul and surface water drainage systems. The most appropriate way of achieving adoption, operation and long-term maintenance of SUDS is presently an agreement under Section 106 of the Town and Country Planning Act, 1990 that provides greater security for the implementation of SUDS and for which templates have been developed. This does not preclude the need for additional negotiations and legal preparatory works on a case-by-case basis, in order to assess the preparedness and willingness to adopt SUDS systems by each stakeholder.

As part of a future detailed WCS & outline SWMP, we recommend the preparation of tailored Outline Model Agreements providing guidance for Operation & Maintenance, in order to improve uptake by providing a mechanism for maintenance. The choice of a Model Agreement and the mechanism for implementation is usually under the responsibility of the LPA.

To assist the four Boroughs and the local developers in the Black Country, we recommend the identification, at an early stage of planning, of the most appropriate legal framework for the various components of the integrated drainage strategy to be managed, most likely in the following situations:
• Implementation and maintenance of SUDS through the planning process, either as a Planning Obligation under Section 106 of the Town and Country Planning Act 1990 or as a condition attached to planning permission

• Implementation and maintenance of SUDS between two or more parties (outside of the requirements for planning permission), i.e. Private SUDS Model Agreements. These are primarily setup to help facilitate ongoing maintenance of SUDS that are in private ownership (large landowner, housing association, corporate body or single household).

The following table, based on Defra's Interim Code of Practice for Sustainable Drainage Systems (2004) provides guidance on the most suitable mechanisms for maintenance. As the overall drainage strategies for the proposed Development Corridors reach their final stage, each component or group of components of the drainage system should be attributed one of the following three Model Agreements. The choice of Model Agreement and the mechanism for implementation will usually be determined by the Local Authorities.
Table 7-4 - SUDS Adoption & Maintenance Guidance

<table>
<thead>
<tr>
<th>Type of Model Agreement</th>
<th>Planning obligation under Section 106 of the Town and Country Planning Act</th>
<th>Condition attached to Planning Permissions which require SUDS</th>
<th>Private Model Agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Incorporating Maintenance Framework Agreement</td>
<td>With stand alone Maintenance Agreement</td>
<td></td>
</tr>
<tr>
<td>Description</td>
<td>Legal agreement to enforce a properly implemented and maintained SUDS scheme. The Maintenance Framework Agreement sets out responsibilities for implementation and maintenance.</td>
<td>Requires the developer to use SUDS within the development. An agreement should be produced to facilitate ongoing maintenance.</td>
<td></td>
</tr>
<tr>
<td>SUDS implementation and maintenance required as part of the planning process?</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>Type of SUDS Scheme</td>
<td>Large / Complex</td>
<td>Small / Simple</td>
<td>Small / Simple</td>
</tr>
<tr>
<td>Level of control required by Local Authority</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Advantages</td>
<td>- Offers more security as it may only be varied by agreement. - Allows for financial contributions in the form of a bond or a periodic payment.</td>
<td>More flexible approach</td>
<td>- Facilitates ongoing maintenance of SUDS that are in private (freehold) ownership. - Suitable for either existing or new developments.</td>
</tr>
<tr>
<td>Drawbacks</td>
<td>The Section 106 route requires negotiations and legal preparatory work in advance of the development taking place.</td>
<td>- Planning conditions can be appealed against. - Enforcement can be difficult.</td>
<td>Shared responsibilities between the customer and the maintainer may become a problem in case of a failure of SUDS that affects downstream areas.</td>
</tr>
</tbody>
</table>

Also, it is recommended that the Councils consider establishing criteria for the performance of SUDS systems. Even though no conditions have been placed on the maintainer for the performance of the SUDS, it is crucial to secure funding in order to demonstrate the long term impact of SUDS on both the quantity and quality of water leaving the site as well as environmental and social implications.
8 Wastewater Treatment and Collection

8.1 Introduction

The wastewater treatment and collection section addresses two key issues:

1. baseline with respect to treatment of wastewater and how much ‘spare’ capacity is available in existing wastewater treatment facilities; and

2. baseline with respect to wastewater or sewer network and whether there is scope to use the existing network system before upgrades are required.

It is important to establish the baseline and hence spare capacity of wastewater treatment facilities and network because a basic assumption of the WCS is that it is preferable to maximise the use of existing facilities where feasible and also develop strategic upgrade solutions. By maximising existing infrastructure, costs may be minimised, and potentially the most sustainable options could be encouraged (e.g. minimising initial carbon footprint of new development). Adopting such an approach may also reduce impact on existing neighbouring communities and allow the early phasing of some new development, which would not have to rely on longer lead in times associated with securing funding for new infrastructure through the statutory water company planning process.

An important aspect of the spare capacity of the existing wastewater treatment facilities is the assessment of the environmental capacity of the receiving watercourses. Discharge of additional treated wastewater from new development could have a detrimental impact on the water quality of receiving watercourses, the hydrological/hydraulic regime of receiving waters and associated habitats and the flood risk downstream of the discharge.

As part of any future WCS, it will be important to fully assess existing wastewater infrastructure and also determine any spare capacity of local wastewater treatment works (WwTW).

8.2 Data Availability

Various types of information have been supplied by the Environment Agency and Severn Trent (ST) for the wastewater baseline assessment including:

- Dry Weather Flow (DWF) and Quality Consent details for wastewater treatment works (WwTW) in the Black Country;
- WwTW size and population details;
- Sewer network records in GIS format. These show the layout of the sewer network and include information such as sewer pipe sizes, sewer type and gradient; and
- Infrastructure and Deliverability Study (Mott MacDonald, 2009).

41 the network of pipes and pumping stations which are used to transmit wastewater from buildings to treatment facilities
42 Dry Weather Flow (DWF) is a unit of measure, used by the Environment Agency in a consent, to describe the maximum daily volume Seven Trent Water (ST) can discharge from a wastewater treatment works (WwTW). It is defined as “The average daily flow of sewage during seven consecutive days without rain following seven days during which the rainfall did not exceed 0.25mm on any one day, averaged over a summer and winter period”. In industrial towns the seven days are replaced by five working days. In practice this is very difficult to measure and is usually estimated using a formula.
8.3 Wastewater Treatment Baseline and Capacity

8.3.1 Introduction

The wastewater treatment and baseline capacity assessment identifies the WwTW in the Black Country study area that are likely to be impacted by proposed growth within the area and assess the current and future potential volumetric (headroom) capacity.

Severn Trent Water (ST) are responsible for operation and maintenance of the existing foul sewerage system and surface water drainage within the Black Country, but they are not responsible for soakaways, land drainage, highways drainage, SUDS or septic systems.

For the purposes of the Outline WCS, ST did not provide information pertaining to the ‘process capacity’ at the WwTWs. Process capacity refers to the amount of flow that can be treated to the required quality standards as set under the discharge consent. Therefore, it has been agreed that the headroom capacity at the WwTW is calculated from the volumetric capacity (i.e. the difference between the maximum dry weather flow (DWF) that ST are permitted to discharge under the discharge consent and the current DWF that is treated from the existing population). This is based on the assumption that ST would seek the funding required to upgrade the processes in the works (if necessary) to treat the additional flow to the standard required under the existing licence.

Whilst this assumption is acceptable for the Outline WCS to determine the feasibility of using the volumetric headroom at the WwTWs, any Detailed WCS will need to revisit these assumptions in conjunction with ST who will assess the actual process capacity and need for process improvements. The review process should take into account finalised housing figures, occupancy rates and consumption (based on water efficiency targets). As a final output, any proposed Detailed WCS review should also provide information on if/when funding is required to upgrade the process capacity at the WwTWs. Any new upgrades or infrastructure requires funding to be sought by ST and as such, there is an associated lead in time for the upgrade works which would limit the amount of development that could take place before the upgrades are in place.

It was noted in the Infrastructure and Deliverability Study that in general there should not be any major capacity issues at the main WwTWs serving development in the Black Country (Minworth and Barnhurst), due to the size of the WwTWs in comparison to the scale of proposed development. The study did however identify that the complex systems across the Black Country are heavily influenced by rainfall do the prevalence of combined systems, however it also notes that “whilst the water company are aware of the current performance issues across the catchment in relation to sewer flooding problems, they are already developing solutions to alleviate known problems but as with all new development proposals they would look to ensuring future sewer performance is not detrimentally affected by new development”.

8.3.2 Assumptions

The following global assumptions, based on latest available data, have been used for the Black Country WCS wastewater baseline and capacity assessment:

- The resident (domestic) population (Pd) and non-resident (holiday) population (Ph) represent the current population being served by the WwTWs at June 2008;
• The per capita consumption for the domestic population (Gd – water used per head, per day) is taken as 137 l/h/d. This is based on the ST regional average between metered and unmetered houses (Draft WRMP43);

• The per capita consumption for the non-resident population (Gh – water used per head, per day) is taken as 55 l/h/d;

• The per capita consumption for commercial jobs (Gc) is taken as 28 l/h/d;

• The infiltration (I) rate44 will be calculated as 25% of the domestic and holiday population multiplied by the stated per capita consumptions (PG = (Domestic Population (Pd) x Domestic Consumption (Gd)) + (Holiday Population (Ph) x Holiday Consumption (Gh))) and that for future calculation of I, the additional infiltration is calculated as 25% of future PG;

• Dry Weather Flow (DWF) is calculated as PG + I + E where E is the volume of trade effluent discharged in the catchment (m³d⁻¹);

• Flow to Full Treatment45 (FtFT) is calculated as 3PG + I + 3E;

• The future per capita consumption for new development (Gf – water used per head, per day) is taken as 133 l/h/d. This is based on ST’s statement of response to their consultation on the draft WRMP (Draft WRMP46);

• No increase in non-resident consumption has been assumed; and

• The occupancy rate is 2.4 per dwelling (Draft WRMP47).

8.3.3 Existing Wastewater Treatment Works

There are six WwTW located within and serving the Black Country study area, with a further eight WwTWs bordering and serving some of the population within the study area. Some of these works have the potential to be impacted by development within the Black Country itself, and therefore a review of the wastewater network has been undertaken to identify those works likely to be impacted by growth up to 2025. All WwTWs within and bordering the study area are summarised in Table 8-1 and the locations shown in Figure 8-1. Eight WwTWs have been identified as being likely to be impacted by growth in the study area and will therefore be assessed as part of this Outline WCS. These assumptions need to be confirmed as part of any future Detailed WCS.

44 Infiltration in this sense is defined as the amount of water that enters the drainage system from other sources such as ingress of groundwater through defective pipes or joints in either public sewers or private sewers and drains.
45 Flow to Full Treatment (FtFT) is the maximum rate of flow that can be treated at a WwTW
Table 8-1: Summary of WwTW Within and Bordering the Black Country Study Area

<table>
<thead>
<tr>
<th>WwTW</th>
<th>Principle Local Authority</th>
<th>Receiving Watercourse</th>
<th>NGR</th>
<th>DWF Consent (m³d⁻¹)</th>
<th>WCS Assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barnhurst</td>
<td>Wolverhampton</td>
<td>Shropshire Union Canal</td>
<td>SJ9000001650</td>
<td>47,500</td>
<td>✓</td>
</tr>
<tr>
<td>Goscote</td>
<td>Walsall</td>
<td>Rough Brook</td>
<td>SK0219001920</td>
<td>24,900</td>
<td>✓</td>
</tr>
<tr>
<td>Lower Gornal</td>
<td>Dudley</td>
<td>Bobs/Holbeche Brook</td>
<td>SO9020090910</td>
<td>8,500</td>
<td>✓</td>
</tr>
<tr>
<td>Ray Hall</td>
<td>Sandwell</td>
<td>River Tame</td>
<td>SP0290093700</td>
<td>60,826</td>
<td>✓</td>
</tr>
<tr>
<td>Walsall Wood</td>
<td>Walsall</td>
<td>Ford Brook</td>
<td>SK0355003880</td>
<td>4,784</td>
<td>✓</td>
</tr>
<tr>
<td>Willenhall</td>
<td>Walsall</td>
<td>River Tame (Wolverhampton Arm)</td>
<td>SO976098160</td>
<td>14,000</td>
<td>✓</td>
</tr>
<tr>
<td>Cannock</td>
<td>-</td>
<td>Staffordshire &amp; Worcestershire Canal</td>
<td>SJ9727008650</td>
<td>17,600</td>
<td>×</td>
</tr>
<tr>
<td>Coven Heath</td>
<td>-</td>
<td>-</td>
<td>SJ9109004730</td>
<td>8,210</td>
<td>×</td>
</tr>
<tr>
<td>Codsall</td>
<td>-</td>
<td>-</td>
<td>SJ88360003740</td>
<td>2,784</td>
<td>×</td>
</tr>
<tr>
<td>Gospel End</td>
<td>-</td>
<td>-</td>
<td>SO902909350</td>
<td>2,890</td>
<td>×</td>
</tr>
<tr>
<td>Minworth</td>
<td>Birmingham</td>
<td>River Tame</td>
<td>SP165092355</td>
<td>450,000</td>
<td>×</td>
</tr>
<tr>
<td>Rugby</td>
<td>-</td>
<td>River Avon</td>
<td>SP494207350</td>
<td>18,670</td>
<td>×</td>
</tr>
<tr>
<td>Roundhill</td>
<td>-</td>
<td>Gallows Brook/River Stour</td>
<td>SO8708083820</td>
<td>59,836</td>
<td>✓</td>
</tr>
<tr>
<td>Trescott</td>
<td>-</td>
<td>-</td>
<td>SO8549097630</td>
<td>6,460</td>
<td>×</td>
</tr>
<tr>
<td>Wombourne</td>
<td>-</td>
<td>Smestow Brook</td>
<td>SO8559091980</td>
<td>3,289</td>
<td>✓</td>
</tr>
</tbody>
</table>

Note: a – Only Total Daily Flow was available for this WwTW and therefore for the purposes of the wastewater treatment assessment the flow has been converted into DWF.

8.3.4 Wastewater Treatment Volumetric Capacity

8.3.4.1 Current Volumetric Capacity

Headroom is calculated by determining the difference between the consented upper limit on DWF, and the DWF that the WwTW currently treats. Using the assumptions defined in Section 8.3.2, the number of future homes and population equivalent that could be accommodated in the future can be estimated, and when new infrastructure upgrades to the WwTW may be required. Dependent on the number of new housing being assessed, the spare capacity will vary because infiltration allowance (calculated as 25% of the population multiplied by the per capita consumption) increases with population, which further reduces the capacity.

The discharge consent information supplied by the Environment Agency indicates the current consented DWF, and from this, and using the population equivalent information provided by ST and the assumptions in Section 8.3.2, the volumetric (headroom) capacity for the five WwTWs has been estimated. The headroom in terms of the numbers of new dwellings that can be served at each of the works has also been calculated. A summary in terms of current volumetric capacity each of the works is provided below.
## Table 8-2: Current WwTW Capacity

<table>
<thead>
<tr>
<th>WwTW</th>
<th>DWF Consent (m$^3$d$^{-1}$)</th>
<th>Calculated DWF (m$^3$d$^{-1}$)</th>
<th>Headroom %</th>
<th>DWF (m$^3$d$^{-1}$)</th>
<th>Dwellings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barnhurst</td>
<td>47,500</td>
<td>20,400</td>
<td>57%</td>
<td>27,100</td>
<td>67,925</td>
</tr>
<tr>
<td>Goscote</td>
<td>24,900</td>
<td>17,280</td>
<td>31%</td>
<td>7,620</td>
<td>19,100</td>
</tr>
<tr>
<td>Lower Gornal</td>
<td>8,500</td>
<td>5,425</td>
<td>36%</td>
<td>3,075</td>
<td>7,700</td>
</tr>
<tr>
<td>Ray Hall</td>
<td>60,826</td>
<td>13,225</td>
<td>78%</td>
<td>47,600</td>
<td>119,300</td>
</tr>
<tr>
<td>Roundhill</td>
<td>59,836</td>
<td>46,725</td>
<td>22%</td>
<td>13,111</td>
<td>32,860</td>
</tr>
<tr>
<td>Walsall Wood</td>
<td>4,784</td>
<td>3,780</td>
<td>21%</td>
<td>1,004</td>
<td>2,515</td>
</tr>
<tr>
<td>Wollenhall</td>
<td>14,000</td>
<td>6,610</td>
<td>53%</td>
<td>7,390</td>
<td>18,526</td>
</tr>
<tr>
<td>Wombourne*</td>
<td>3,289</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: 1. No information was provided from this work so an estimated population, based on publicly available information, was used.
2. No information was provided for this WwTW

### 8.3.4.2 Barnhurst WwTW

Barnhurst WwTW has a DWF consent, and therefore volumetric capacity, of 47,500 m$^3$d$^{-1}$. The calculated DWF for the works is 20,400 m$^3$d$^{-1}$, giving rise to a headroom capacity of around 27,100 m$^3$d$^{-1}$, 57% of the current DWF consent. Using the assumptions provided in Section 8.3.2, this headroom is sufficient to allow the WwTW to treat flow from around 67,900 new homes before an upgrade or new WwTW will be required.

### 8.3.4.3 Goscote WwTW

Goscote WwTW has a DWF consent, and therefore volumetric capacity, of 24,900 m$^3$d$^{-1}$. The calculated DWF for the works is 17,280 m$^3$d$^{-1}$, giving rise to a headroom capacity of around 7,620 m$^3$d$^{-1}$, 31% of the current DWF consent. Using the assumptions provided in Section 8.3.2, this headroom is sufficient to allow the WwTW to treat flow from around 19,000 new homes before an upgrade or new WwTW will be required.

### 8.3.4.4 Lower Gornal WwTW

Lower Gornal WwTW has a DWF consent, and therefore volumetric capacity, of 8,500 m$^3$d$^{-1}$. The calculated DWF for the works is 5,425 m$^3$d$^{-1}$, giving rise to a headroom capacity of around 3,075 m$^3$d$^{-1}$, 36% of the current DWF consent. Using the assumptions provided in Section 8.3.2, this headroom is sufficient to allow the WwTW to treat flow from around 7,700 new homes before an upgrade or new WwTW will be required.

### 8.3.4.5 Ray Hall WwTW

Ray Hall WwTW has a DWF consent, and therefore volumetric capacity, of 60,826 m$^3$d$^{-1}$. The calculated DWF for the works is 13,225 m$^3$d$^{-1}$, giving rise to a headroom capacity of around 47,600 m$^3$d$^{-1}$, 21% of the current DWF consent. Using the assumptions provided in Section 8.3.2, this headroom is sufficient to allow the WwTW to treat flow from around 119,300 new homes before an upgrade or new WwTW will be required.

### 8.3.4.6 Roundhill WwTW

Roundhill WwTW has a DWF consent, and therefore volumetric capacity, of 59,836 m$^3$d$^{-1}$. The calculated DWF for the works is 46,725 m$^3$d$^{-1}$, giving rise to a headroom capacity of around 13,111 m$^3$d$^{-1}$, 22% of the current DWF consent. Using the assumptions provided in Section 8.3.2, this headroom is sufficient to allow the
WwTW to treat flow from around 32,860 new homes before an upgrade or new WwTW will be required.

8.3.4.7  Walsall Wood WwTW

Walsall Wood WwTW has a DWF consent, and therefore volumetric capacity, of 4,784 m$^3$d$^{-1}$. The calculated DWF for the works is 3,780 m$^3$d$^{-1}$, giving rise to a headroom capacity of around 1,004 m$^3$d$^{-1}$, 78% of the current DWF consent. Using the assumptions provided in Section 8.3.2, this headroom is sufficient to allow the WwTW to treat flow from around 2,515 new homes before an upgrade or new WwTW will be required.

8.3.4.8  Willenhall WwTW

Willenhall WwTW has a DWF consent, and therefore volumetric capacity, of 14,000 m$^3$d$^{-1}$. The calculated DWF for the works is 6,610 m$^3$d$^{-1}$, giving rise to a headroom capacity of around 7,390 m$^3$d$^{-1}$, 53% of the current DWF consent. Using the assumptions provided in Section 8.3.2, this headroom is sufficient to allow the WwTW to treat flow from around 18,256 new homes before an upgrade or new WwTW will be required.

8.3.4.9  Wombourne WwTW

Wombourne WwTW has a DWF consent, and therefore volumetric capacity, of 3,289 m$^3$d$^{-1}$. No information was made available to calculate the capacity of the works. The DWF consent at the works allows a total of 8,243 houses to be served by the works before an upgrade would be required.

8.3.4.10  Future Volumetric Capacity

As an indication of where potential future capacity constraints may exist, based on proposed housing and employment figures at the time of this study, a calculation of future capacity at the eight WwTWs has been undertaken making the following assumptions:

- Growth from Regeneration Corridors RC2 and RC3 and Strategic Centre SC1 (Wolverhampton) will be discharged to and treated at Barnhurst WwTW;
- Growth from Regeneration Corridors RC7 will be discharged to and treated at Goscote WwTW;
- Growth from Regeneration Corridors RC10 and RC11 and Strategic Centre SC3 (Brierley Hill) will be discharged to and treated at Lower Gornal WwTW;
- Growth from Regeneration Corridors RC8, RC9, RC12, RC16 and Strategic Centre SC2 (Walsall) will be discharged to and treated at Ray Hall WwTW;
- Growth from Regeneration Corridors RC11, RC13, RC14 and Strategic Centre SC3 (Brierley Hill) will be discharged to and treated at Roundhill WwTW;
- Growth from Regeneration Corridors RC15 will be discharged to and treated at Walsall Wood WwTW;
- Growth from Regeneration Corridors RC4, RC6 and Strategic Centre SC1 (Wolverhampton) will be discharged to and treated at Willenhall WwTW; and
- Growth from Regeneration Corridors RC11, RC13, RC14 and Strategic Centre SC3 (Brierley Hill) will be discharged to and treated at Wombourne WwTW.
Where growth from a regeneration corridor or strategic centre has been identified as falling within the catchment of more than one WwTW, the growth has been evenly split between the identified works.

The results of the capacity assessment are provided in Table 8-3. It is important to note that the future capacity assessment is only provided as an indication of potential future constraints at present and will need to be revisited at an early stage of the Detailed WCS. The assessment shows that there is adequate capacity at all works (where data has been made available) to accommodate the proposed growth.

### Table 8-3: Potential Future WwTW Capacity

<table>
<thead>
<tr>
<th>WwTW</th>
<th>Development Areas</th>
<th>Proposed Growth</th>
<th>Future (2025) Capacity (%)</th>
<th>Headroom¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dwellings</td>
<td>DWF (m³d⁻¹)</td>
<td>Dwellings</td>
<td></td>
</tr>
<tr>
<td>Barnhurst</td>
<td>RC2, RC3, SC1</td>
<td>3,202</td>
<td>54%</td>
<td>25,825</td>
</tr>
<tr>
<td>Goscote</td>
<td>RC7</td>
<td>765</td>
<td>29%</td>
<td>7,315</td>
</tr>
<tr>
<td>Lower Gornal</td>
<td>RC10, RC11, SC3</td>
<td>2,765</td>
<td>23%</td>
<td>1,971</td>
</tr>
<tr>
<td>Ray Hall</td>
<td>RC8, RC9, RC12,</td>
<td>16,928</td>
<td>67%</td>
<td>40,846</td>
</tr>
<tr>
<td></td>
<td>RC16, SC2</td>
<td></td>
<td></td>
<td>102,371</td>
</tr>
<tr>
<td>Roundhill</td>
<td>RC11, RC13, RC14, SC3</td>
<td>8,657</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walsall Wood</td>
<td>RC15</td>
<td>544</td>
<td>16%</td>
<td>787</td>
</tr>
<tr>
<td>Willenhall</td>
<td>RC4, RC6, SC1</td>
<td>7,277</td>
<td>32%</td>
<td>4,489</td>
</tr>
<tr>
<td>Wombourne²</td>
<td>RC10, RC11, SC3</td>
<td>2,764</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Note:  
1 - The headroom is calculated in terms of housing/dwellings only  
2 - No information was provided for this WwTW

#### 8.3.4.11 Assumption Sensitivity

The conclusions for the housing that can be accommodated by the existing capacity of the WwTW are sensitive to assumptions applied to the calculations, and in particular to the assumption applied to the per capita consumption and infiltration (which is calculated as 25% of the population consumption). With the publication of the Code for Sustainable Homes this is a considerable drive to move towards more water efficient developments where water consumption is reduced by a number of measures. A reduction in water usage would significantly reduce the wastewater generated from new properties which could result in more properties being able to be treated at the WwTWs using any existing headroom capacity. However, whilst water efficiency will reduce the volume of sewage produced from new housing, this will tend to increase the strength of the sewage. Consequently, as the volumetric capacity is increased, the biological capacity is reduced, and therefore the capacity at the works is not necessarily released for more housing as result of these measures.

Detailed trade flow information was not made available for this study by ST and therefore calculations have been based on provided trade population equivalent figures and the assumptions provided in Section 8.3.2. In terms of trade flow, the volume of wastewater generated is likely to be underestimated and therefore it is likely that there is less capacity at the WwTWs than that calculated. These assumptions will need to be revisited and assessed on a site by site basis as part of the Detailed WCS in conjunction with ST to confirm the current capacity at each of the works and the future capacity.
8.3.5 Wastewater Treatment Process Capacity

8.3.5.1 Legislation

There are several pieces of legislation which are relevant to WwTW’s, of these the Urban Waste Water Treatment Directive (UWWTD) and Freshwater Fish Directive (FFD) are particularly important in terms of the setting of quality consents for WwTWs. Implications of new water classification and standards under the Water Framework Directive are discussed in Chapter 9.

8.3.5.2 Urban Waste Water Treatment Directive

The Urban Wastewater Treatment Directive (UWWTD) is designed to make sure all wastewater in the EU is treated to the appropriate standard. An essential element of the Directive is that quality standards for effluent fall into categories depending on size of the treatment works and the sensitivity of the receiving water. As populations grow in each sewerage catchment, some sewage treatment works may exceed the Urban Waste Water Treatment Directive threshold that requires nutrient removal.

For works discharging into a Sensitive Area (Eutrophic) a population equivalent exceeding 10,000 will require phosphate removal to a standard of $2 \text{ mg l}^{-1}$ (as an annual average). If however the population equivalent is increased to exceed 100,000, then a tighter standard of $1 \text{ mg l}^{-1}$ (as an annual average) phosphorous is required. It is clear that growth in some areas could result in tighter limits on the quality of the effluent and this could have implications for investment in new sewage treatment infrastructure.

8.3.5.3 Fresh Water Fish Directive

The Fresh Water Fish Directive is designed to protect fish from harmful chemicals such as ammonia. The East Midlands has a significant number of rivers designated under this Directive. Many sewage treatment works on rivers such as the Trent have already had major investment in order to meet the tight ammonia standards required in this Directive. Any new discharges into these rivers must also meet the Fresh Water Fish Directive standards. There may be implications for the capacity of current works and the cost of investment in new works.

8.3.5.4 Current Process Capacity

The consents for the eight WwTWs principally serving the Black Country have been supplied by the Environment Agency and are shown in Table 8-4.

<table>
<thead>
<tr>
<th>WwTW</th>
<th>DWF</th>
<th>BOD ATU as O2</th>
<th>Ammonia as N</th>
<th>Solids Suspended @ 105°C</th>
<th>Phosphorus as P (by 2014)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>m³d⁻¹</td>
<td>95%ile</td>
<td>95%ile</td>
<td>Mean</td>
<td>mg l⁻¹</td>
</tr>
<tr>
<td>Barnhurst</td>
<td>47,500</td>
<td>10</td>
<td>3</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>Goscote</td>
<td>24,900</td>
<td>20</td>
<td>10</td>
<td>30</td>
<td>1</td>
</tr>
<tr>
<td>Lower Gornal</td>
<td>8,500</td>
<td>25</td>
<td>10</td>
<td>45</td>
<td>2</td>
</tr>
<tr>
<td>Ray Hall</td>
<td>60,826</td>
<td>25</td>
<td>3</td>
<td>45</td>
<td>1</td>
</tr>
<tr>
<td>Roundhill</td>
<td>59,836</td>
<td>10</td>
<td>5</td>
<td>20</td>
<td>1</td>
</tr>
<tr>
<td>Walsall Wood</td>
<td>4,784</td>
<td>25</td>
<td>10</td>
<td>45</td>
<td>2</td>
</tr>
<tr>
<td>Willenhall</td>
<td>14,000</td>
<td>20</td>
<td>-</td>
<td>30</td>
<td>2</td>
</tr>
<tr>
<td>Wombourne</td>
<td>3,289</td>
<td>20</td>
<td>10</td>
<td>40</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 8-4: WwTW Quality Consents for Black Country
These consents are likely to require tightening to meet the proposed WFD water quality standards under current conditions. Current Best Available Technology (BAT) consents are 5 mg/l BOD (95%ile), 1 mg/l Ammonia (95%ile) and 1 mg/l Phosphorus; with current technology it is not possible to treat effluent below this quality. Therefore works that are currently treating effluent close to BAT i.e. Barnhurst WwTW will have less capacity to treat further effluent flow to a tighter standard and therefore may need to seek alternative treatment options to deal with increased effluent discharges as a result of proposed development in the Black Country. This issue should be considered as part of the Detailed WCS with potential options ranging from membrane bioreactor (package treatment) options to lower the levels of BOD and ammonia (in particular), to considering the need for a new WwTW to serve future development. For an area where future development is planned, ST have an obligation to serve that development and therefore this issue should not prevent any related development, however the Detailed WCS would need to determine the most feasible and sustainable options.

Only Barnhurst and Roundhill WwTW currently have UWWTD schemes in place at the works but all other works will introduce UWWTD schemes over the next five years. This will see a Phosphorus consent of 1 mg/l being set at the larger works of Goscote and Ray Hall, and 2 mg/l at the smaller works of Lower Gornal, Walsall Wood and Willenhall. These may improve the water quality downstream of the works.

8.3.5.5 Future Process Capacity

The proposed growth in the Black Country is likely to require a tightening of consents even further than that identified above to ensure that ‘good ecological status’ is achieved and there is no deterioration in water quality downstream of the works as a result of increased effluent discharges. Due to the lack of data from ST and the EA, the required consents will need to be calculated as part of a Monte Carlo modelling exercise for the Detailed WCS, and the results discussed with ST and the Environment Agency to determine whether wastewater from future proposed growth in the Black Country can be adequately treated and discharged at the existing works without causing deterioration in the downstream water environment. The costs associated with any associated upgrades or treatment options will need to be assessed to help guide the decision of where and when future infrastructure to support growth identified in the Core Strategy can be accommodated within the Black Country.

A study produced by the West Midlands Regional Planning Body, Environment Agency and ST, in 2005 reviewed the capacity of WwTWs in the West Midlands to accommodate more houses. The study categorises large sewage treatment works into risk grouping based on the 2005 Environment Agency discharge consent limit. The works to the west of the region were assessed for BOD, ammonia and volume while to the east they were assessed for BOD and volume. This is because many works in the west of the region have an additional ammonia limit to protect fish in rivers designated as fisheries under the Fresh Water Fish Directive.

Table 8-5 shows the risk assessment for both flow and water quality based on increases to effluent discharges as a result of growth in the region. The assessment aimed to identify works which fell into the following two categories:

- The sewage treatment works is already producing a good quality effluent. It may be difficult to improve the quality still further with the current technology; and
• The sewage treatment works can not increase the volume of water discharged without an increase in the risk of downstream flooding.

Several WwTW’s were of ‘Low risk’ or ‘Medium risk’ to changes in flow, but only two, (Lower Gornal and Walsall Wood) were of ‘Low risk’ to water quality. As a result, most WwTw’s were classed as ‘High risk’, with process capacity seemingly the main issue to be addressed.

**Table 8-5 Analysis of risks resulting from housing increases in the Black Country on watercourses from WwTW discharges**

<table>
<thead>
<tr>
<th>WwTW</th>
<th>Flow Risk</th>
<th>Water Quality Risk</th>
<th>Overall Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barnhurst</td>
<td>L</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Goscote</td>
<td>M</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Lower Gornal</td>
<td>M</td>
<td>L</td>
<td>M</td>
</tr>
<tr>
<td>Ray Hall</td>
<td>M</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Roundhill</td>
<td>M</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Walsall Wood</td>
<td>M</td>
<td>L</td>
<td>M</td>
</tr>
<tr>
<td>Willenhall</td>
<td>L</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Wombourne</td>
<td>M</td>
<td>L</td>
<td>M</td>
</tr>
</tbody>
</table>

### 8.4 Current Sewerage Network

Information has been provided by ST on the wastewater network serving the Black Country area.

A high level assessment of the wastewater network has been undertaken for each of the strategic centres and regeneration corridors based on projected housing growth figures provided in the Joint Core Strategy Preferred Options Report (2008) for each area (as described in Section 2). The outline assessment for each area is given in Table 8-6. The assessment does not take into account the capacity generated by demolition and therefore is based on the number of dwellings proposed for each regeneration corridor or strategic centre, a total of 42,900 dwellings.
Table 8-6: Wastewater Network Options and Possible Restrictions

<table>
<thead>
<tr>
<th>Area No.</th>
<th>Name</th>
<th>Proposed No. of Dwellings</th>
<th>WwTW Serving the Area</th>
<th>Comments on Existing Wastewater Network &amp; Possible Restrictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC1</td>
<td>Wolverhampton</td>
<td>2,400</td>
<td>Barnhurst &amp; Willenhall</td>
<td>The area is located relatively close to Barnhurst WwTW and is served by a number of strategic sewers in the centre of the town which drain to both Barnhurst and Willenhall WwTW. There is flexibility to transfer to either catchment within existing pipe network and therefore the proposed development should be able to be accommodated within this area.</td>
</tr>
<tr>
<td>SC2</td>
<td>Walsall</td>
<td>500</td>
<td>Ray Hall</td>
<td>There is a relatively small amount of development planned for this area. The town is served by a number of strategic sewers is located relatively close to Ray Hall WwTW. The area is unlikely to require upgrades to the sewer network, but any proposed development and upgrades to the sewer network will need to be considered alongside RC7.</td>
</tr>
<tr>
<td>SC3</td>
<td>Brierley Hill</td>
<td>3,000</td>
<td>Lower Gornal &amp; Wombourne &amp; Roundhill</td>
<td>There is a reasonable level of development planned for this area which due to its location has the potential to drain to the three WwTWs of Lower Gornal, Wombourne and Roundhill. However, it is located at the upstream end of the Wombourne and Lower Gornal catchments which may make it difficult to support the planned level of development. If the development was planned to drain to Roundhill WwTW, then the impacts of the increased wastewater in the network will need to be assessed in combination with the proposed developments in RC11, RC13, RC14. A more detailed assessment will need to be carried out for this area as, unlike the other strategic centres, there are no existing strategic sewers serving the towns.</td>
</tr>
<tr>
<td>RC2</td>
<td>Stafford Road</td>
<td>1,173</td>
<td>Barnhurst</td>
<td>The area is located close to the Barnhurst WwTW and is served by an existing strategic sewer network. The area is likely to have the capacity to accommodate most of proposed development but this will need to be confirmed in a detailed assessment.</td>
</tr>
<tr>
<td>RC3</td>
<td>South of Wolverhampton City Centre</td>
<td>829</td>
<td>Barnhurst</td>
<td>The area is located at the upstream end of the sewer network that drains to Barnhurst WwTW and a relatively small volume of development is planned for the area. As there are strategic sewers there is the possibility that wastewater generated by the proposed development could be drained by these pipes.</td>
</tr>
<tr>
<td>RC4</td>
<td>Wolverhampton - Bilston</td>
<td>3,910</td>
<td>Willenhall</td>
<td>Given size of the development planned for this area and that it is located towards the top of the Willenhall WwTW catchment there may be a requirement for upgrades and reinforcements to the existing sewer network. Alternatively there may be the option for transfer between catchments to Barnhurst WwTW. These will need to be assessed as part of a detailed modelling exercise.</td>
</tr>
<tr>
<td>RC6</td>
<td>Wednesfield/ Willenhall/ Darlaston</td>
<td>2,167</td>
<td>Willenhall</td>
<td>The area is located close to Willenhall WwTW. There is an existing strategic sewer network throughout the area and this could have the potential to accommodate most of proposed development, which is likely to be dispersed across the relatively large development area.</td>
</tr>
<tr>
<td>RC7</td>
<td>Bloxwich/</td>
<td>1,530</td>
<td>Ray Hall &amp;</td>
<td>The area is served by both Ray Hall and Gosote WwTWs providing the potential to link to either</td>
</tr>
<tr>
<td>Area No.</td>
<td>Name</td>
<td>Proposed No. of Dwellings</td>
<td>WwTW Serving the Area</td>
<td>Comments on Existing Wastewater Network &amp; Possible Restrictions</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------</td>
<td>---------------------------</td>
<td>-----------------------</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Birchills/ Bescot</td>
<td></td>
<td>Goscote</td>
<td>of these sewer networks. There is a large strategic sewer flowing through centre of area with the potential to add connections to this to serve the new development. However, the area is located at the top end of the Ray Hall WWTW and impacts on the downstream network will need to be assessed in conjunction with proposed development at Walsall (SC2).</td>
</tr>
<tr>
<td>RC8</td>
<td>Hill Top</td>
<td>5,160</td>
<td>Ray Hall</td>
<td>There is a large amount of development proposed for this area but it is likely that this will be spread out over quite a large area. There are existing strategic sewers serving the area and these drain to Ray Hall WwTW. Additionally the area is located relatively close to Ray Hall WwTW. The sewer capacity for this development will need to be assessed in combination with the proposed development upstream in RC9, RC12 and RC16 as these are likely to drain into the same strategic network.</td>
</tr>
<tr>
<td>RC9</td>
<td>Tipton/ Dudley Port/ Brades Village</td>
<td>5,228</td>
<td>Ray Hall</td>
<td>The area is located upstream of RC8 and therefore the capacity will need to be assessed in combination with the proposed development in the upstream RC12 and RC16 and the downstream RC8. There is a good coverage of strategic sewers throughout the area.</td>
</tr>
<tr>
<td>RC10</td>
<td>Pensnett/ Kingswinford</td>
<td>625</td>
<td>Lower Gornal &amp; Wombourne</td>
<td>There is a relatively small amount of development planned for this area and the generated wastewater could drain to either Lower Gornal and/or Wombourne. It is likely that the proposed level of development will be able to be accommodated within the existing sewer network.</td>
</tr>
<tr>
<td>RC11</td>
<td>(North) Dudley – Brierley Hill - Stourbridge</td>
<td>4,356</td>
<td>Lower Gornal &amp; Wombourne &amp; Roundhill</td>
<td>There are several options for the distribution of wastewater in this development area. The area is located at the upstream end of Lower Gornal and Wombourne WwTW catchments and the downstream end of the Roundhill WwTW catchment. Development at southern end of the Roundhill sewer network will be relatively easy to accommodate within the existing sewer network which has a number of sizeable pipe connections. However, with the additional proposed development in RC13 and RC14, these pipes may need upgrading.</td>
</tr>
<tr>
<td>RC12</td>
<td>Oldbury/ West Bromwich/ Smethwick</td>
<td>3,119</td>
<td>Ray Hall</td>
<td>The area is located at the upstream end of the sewer network that drains to Ray Hall WwTW. It is upstream of RC8 and RC9 and therefore the capacity within the downstream sewer network will be dependent on development from these areas and RC16 which drains into the same strategic sewer. A detailed network capacity assessment will need to be undertaken for these regeneration corridors to determine the existing capacity in the sewers and any required upgrades to the sewer network to accommodate the proposed level of development.</td>
</tr>
<tr>
<td>RC13</td>
<td>Rowley Regis – Jewellery Line</td>
<td>5,780</td>
<td>Roundhill</td>
<td>There is a significant level of development planned for this area which is located at the upstream end of the sewer network that drains to Roundhill WwTW. Upgrades of the sewer network may be required to accommodate the development. The existing capacity in the sewer network needs to be assessed in conjunction with development in RC14 (upstream) and RC11 (downstream) which drain to same sewer at the downstream end of catchment.</td>
</tr>
<tr>
<td>Area No.</td>
<td>Name</td>
<td>Proposed No. of Dwellings</td>
<td>WwTW Serving the Area</td>
<td>Comments on Existing Wastewater Network &amp; Possible Restrictions</td>
</tr>
<tr>
<td>---------</td>
<td>-------------------------</td>
<td>---------------------------</td>
<td>-----------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>RC14</td>
<td>Coombs Wood – Halesowen</td>
<td>425</td>
<td>Roundhill</td>
<td>The area is located upstream of RC14 and is located at the upstream end of the sewer network that drains to Roundhill WwTW. Therefore the capacity will need to be assessed in combination with the proposed development in RC13 and RC11 which are located downstream.</td>
</tr>
<tr>
<td>RC15</td>
<td>Brownhills</td>
<td>544</td>
<td>Walsall Wood</td>
<td>The area is located close to Walsall Wood WwTW and there are existing connections to the sewer network. The small volume of development planned for this area means that it is likely that there will be existing capacity in the sewer network to accommodate the development.</td>
</tr>
<tr>
<td>RC16</td>
<td>Cosley – Tipton – Princes End</td>
<td>2,154</td>
<td>Ray Hall</td>
<td>The area is located at the upstream end of the sewer network that drains to Ray Hall WwTW. There is also the potential to connect to sewer network that drains to Willenhall WwTW. Capacity within the existing sewer network needs to be assessed for this development area alongside proposed development in RC8, RC9 and RC12 which drain into the same sewer downstream.</td>
</tr>
</tbody>
</table>
A summary of the main points of the wastewater network capacity assessment are as follows;

- The urban nature of the Black Country means that there is a good coverage of existing strategic sewers across the study area. However, any upgrades to the existing sewer network are likely to need to pass through already developed areas which can be relatively expensive and the timescales for delivery of this could be relatively long;

- A detailed modelling exercise should be undertaken for all regeneration corridor and strategic development areas to assess the current capacity within the existing sewer network;

- Key strategic upgrades are likely to be required to deliver the significant development in RC8, RC9, RC12 and RC16. These will feed into the same sewer network which drains to Ray Hall WwTW and therefore development within these areas needs to be assessed in combination through a detailed modelling exercise to determine existing capacity within the sewer network serving these areas and the potential to accommodate the proposed development;

- A significant volume of development is planned for RC11, RC13 and RC14 which will feed into the sewer network that drains to Roundhill WwTW. Key strategic upgrades are likely to be required to deliver development in these areas which feed into sewer network that drains to Roundhill WwTW. Development within these areas needs to be assessed in combination through a detailed modelling exercise to determine existing capacity within the sewer network serving these areas and the potential to accommodate the proposed development;

- The Strategic Centre of Brierley Hill is likely to require key strategic upgrades to the sewer network to deliver the proposed development. Whilst the proposed area has the potential to drain to the three WwTWs of Lower Gornal, Wombourne and Roundhill, the town is located at the upstream end of these catchments and, unlike the other strategic centres, does not currently have a large strategic sewer network.

Given the nature of difficulty in providing upgrades to the sewer network within the Black Country, a key component of the Detailed WCS should be the modelling of the sewer network for the regeneration corridor and strategic centres to confirm the capacity within the existing sewer network. In particular development planned to drain to Ray Hall and Roundhill WwTWs should be investigated along with the wastewater drainage options for the Strategic Centre development of Brierley Hill. The modelling exercise and wastewater capacity assessment will need to be undertaken in conjunction, and agreed, with ST.

### 8.5 Wastewater Treatment and Collection Summary

- There are six WwTWs located within the study area and a further eight bordering the area. Eight of these works have been identified as potentially being impacted by proposed development within the study area and have therefore been assessed as part of the Outline WCS;

- Only limited information has been made available by ST for this assessment;
• All WwTWs (where information was available to undertake the assessment) have sizeable spare capacity to treat flows from new development in the area. However, no detailed information on trade flow was provided and therefore the assumptions that have been made as part of this assessment will need to be revisited in the Detailed WCS to refine the calculated volumetric capacity at the WwTWs;

• The existing sewer network has been used to identify the volume of proposed development that is likely to be served by each of the WwTWs and this has been used to calculate the future wastewater flows to be treated at the works and therefore future capacity;

• Based on the proposed housing development in the area, all WwTWs have the capacity to treat the new development without requiring any upgrades to the existing wastewater treatment works (in terms of volumetric capacity);

• WwTW quality consents are likely to require tightening under the WFD and as a result of the proposed growth within the area to comply with WFD standards. Some of the consents, particularly at Barnhurst WwTW are already close to BAT and therefore alternative treatment options may be needed to treat the additional effluent generated from the proposed development in the study area. A Monte Carlo modelling exercise will need to be carried out as part of the Detailed WCS to determine the future consents required under the WFD for future effluent discharges; and

• The wastewater network assessment showed that there is a good coverage of existing strategic sewers across the study area which will facilitate new connections to the existing network. However, detailed modelling will need to be undertaken to assess the capacity in the network especially in areas where more than one regeneration corridor will feed into the same sewer i.e. Ray Hill and Roundhill catchments, or the area does not currently have an existing strategic network but significant growth is planned, i.e. Brierley Hill.
9 Water Quality

9.1 Introduction

Discharge of new, or additional, treated wastewater from the proposed growth areas could have a detrimental impact on the water quality of receiving waters. A review of water quality in the WCS is therefore important to ensure that:

- The water related environment has the capacity to absorb further discharges to the receiving watercourse;
- There is no unacceptable deterioration in the quality of the water related environment as a result of the development; and
- Any water quality mitigation measures are planned in a strategic manner.

The aim of assessing the current and potential water quality of watercourses within and surrounding the Black Country is to identify the current water quality situation and the potential impacts the development may have on this and the surrounding water environment.

Given the large area of the Black Country, and several catchments, this assessment will be an overview of the main water quality issues, focussing specifically on a high–level assessment of water quality impacts from the main Wastewater Treatment Works (WwTW) as identified in Chapter 8.

9.2 Current Water Quality Baseline

9.2.1 Introduction

9.2.1.1 Environment Agency’s River Ecosystem Classification and General Quality Assessment

Historically the Environment Agency have used River Quality Objectives (RQOs), planned targets for water quality, to help protect and improve the quality of the water in watercourses. The principal non-statutory RQO system is the River Ecosystem (RE) Classification scheme which comprises five hierarchical classes in order of decreasing quality, ranging from ‘very good quality’ to ‘poor quality’ (Table 9-1). Each stretch of river is given a RE target such that if the river achieves this target it means that the river will be of adequate quality to support the required ecosystem.
Table 9-1: Environment Agency’s River Ecosystem Classification Summary

<table>
<thead>
<tr>
<th>Class</th>
<th>Quality</th>
<th>Description/Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE1</td>
<td>Very good quality</td>
<td>Suitable for all fish species</td>
</tr>
<tr>
<td>RE2</td>
<td>Good quality</td>
<td>Suitable for all fish species</td>
</tr>
<tr>
<td>RE3</td>
<td>Fairly good quality</td>
<td>Suitable for high-class coarse fisheries</td>
</tr>
<tr>
<td>RE4</td>
<td>Fair quality</td>
<td>Suitable for course fisheries</td>
</tr>
<tr>
<td>RE5</td>
<td>Poor quality</td>
<td>Likely to limit fish populations</td>
</tr>
</tbody>
</table>

Whereas the Environment Agency use RQOs for planning purposes (i.e. for setting water quality targets and assessing compliance with those targets), the General Quality Assessment (GQA) scheme is designed to provide an assessment of the general state of water quality and changes in this state over time. The GQA scheme comprises several separate aspects of water quality falling under chemical (inc. nutrients) and biological monitoring and assessment (Table 9-2). A monitoring programme at a set number of sites has been undertaken on a monthly basis to assess the quality of individual stretches of river.

Table 9-2: General Quality Assessment (GQA) Classes for Chemistry and Biology

<table>
<thead>
<tr>
<th>Chemistry Assessment</th>
<th>Biology Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grade</strong></td>
<td><strong>Quality</strong></td>
</tr>
<tr>
<td>A</td>
<td>Very Good</td>
</tr>
<tr>
<td>B</td>
<td>Good</td>
</tr>
<tr>
<td>C</td>
<td>Fairly Good</td>
</tr>
<tr>
<td>D</td>
<td>Fair</td>
</tr>
<tr>
<td>E</td>
<td>Poor</td>
</tr>
<tr>
<td>F</td>
<td>Bad</td>
</tr>
</tbody>
</table>

<sup>48</sup> Provided other standards are met

<sup>49</sup> Where the grade is caused by discharges of organic pollution

<sup>50</sup> As footnote 5
As well as the chemical and biological quality, river systems are also sampled to determine the concentration of nutrients in given reaches. Excessive nutrients (especially phosphorus) can allow eutrophication if other factors are not limiting. This allows nuisance species such as algae to proliferate at an undesirable level and at the expense of other aquatic life which rely on the system (fish and aquatic plants); the overall effect is to reduce biodiversity. The two most important nutrients in terms of eutrophication are nitrogen (N) and phosphorus (P); these are each assessed using a separate GQA grade (Table 9-3).

### Table 9-3: General Quality Assessment (GQA) Classes for Nutrients

<table>
<thead>
<tr>
<th>Nitrate Grades (Grade limit (mg NO3/l) (Mean))</th>
<th>Description</th>
<th>Phosphate Grades (Grade limit (mg P/l) (Mean))</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>Very Low</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>Low</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>Moderately Low</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>30</td>
<td>Moderate</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>40</td>
<td>High</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>&gt;40</td>
<td>Very High</td>
<td>6</td>
</tr>
</tbody>
</table>

Nutrient concentrations in rivers exhibit considerable spatial and seasonal variability, and in common with other GQA sampling, monthly ‘grab’ samples will not reflect the true temporal variation. Storm events, for example, can mobilise nutrients from several sources and transient, but potentially very important, large concentrations of substances such as N and P will not be captured by monthly sampling regimes. There are also seasonal effects, such as a natural ‘flush’ of nitrate from soil during early autumn as the soil reaches field capacity and field drains begin to flow.

A grade from 1 to 6 is derived for both phosphate and nitrate based on the average concentration over the previous three years. There are no set ‘good’ or ‘bad’ concentrations for nutrients in rivers in the way that is used to describe chemical and biological quality. Rivers in different parts of the country have naturally different concentrations of nutrients. ‘Very low’ nutrient concentrations, for example, are not necessarily good or bad; the classifications merely state that concentrations in this river are very low relative to other rivers.

Of all forms of P, it is desirable to determine the concentrations of Soluble Reactive Phosphorus (SRP) as this form of P is most immediately available to aquatic macrophytes and algae. Phosphorus is usually the limiting nutrient in inland freshwaters and gives an indication of the likelihood of eutrophication within a water environment.

#### 9.2.1.2 Freshwater Fish Directive

As well as the RE Classification scheme and GQA, waters are also designated and assessed against the Freshwater Fish Directive. The EC Freshwater Fish Directive (78/659/EEC) was adopted in 1978 and updated in 2006 (2006/44/EC), and seeks to protect those fresh water bodies identified by Member States as waters suitable for sustaining fish populations51. For those waters it sets physical and chemical water quality objectives for salmonid and cyprinid waters:

---

o **Salmonid fish** (salmon and trout) - these are generally fast flowing stretches of river that have a high oxygen content and a low level of nutrients; and

o **Cyprinid fish** (coarse fish - carp, tench, barbel, rudd, roach) - these are slower flowing waters, that often flow through lowlands.

The Directive sets different standards for salmonid and cyprinid. There are two types of standards within each water category:

- **Imperative values** - these are standards that must be met if the stretch is to pass the Directive (for the stretch to be 'compliant'). Values have been set for dissolved oxygen, pH, non-ionised ammonia, total ammonium, total residual chlorine, zinc and (for thermal discharges) temperature; and

- **Guideline values** - these are quality standards that should be achieved where possible. Values have been set here for other chemical parameters, such as copper, biochemical oxygen demand and suspended solids.

In 2013, this directive will be repealed and waters currently designated as Fish Directive waters will become protected areas under the Water Framework Directive.

### 9.2.2 Baseline Assessment

Water quality within surface water systems has the potential to be affected primarily by increases in effluent discharges from WwTWs and urban diffuse runoff as a result of development within the catchment. Therefore, water quality assessment and baseline has been focused on those stretches of main river52 likely to be impacted by development, i.e. downstream of WwTWs and near major development areas.

There are six WwTWs in the Black Country study area: Barnhurst, Goscote, Lower Gornal, Ray Hall, Walsall Wood and Willenhall. These discharge into watercourses as shown in Table 9-4 respectively. The River Stour (Roundhill STW to Cookley Road Bridge) and Smestow Brook are both designated Cyprinid Fisheries.

Recent RE compliance information and GQA grades for the river stretches upstream and downstream of the WwTWs are reported in Table 9-4, covering three most recent reporting periods i.e. the 2007 reporting period covers the period 2005 – 2007; 2006 period the period 2004 – 2006.

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52 Under the Water Resources Act, 1991, the Environment Agency has powers to maintain and improve 'main rivers' for the efficient passage of flood flow and the management of water levels. These powers are permissive only, so there is no obligation on the Environment Agency to carry out either maintenance or new works on main river. Main rivers are usually larger streams and rivers, but also include smaller watercourses of strategic drainage importance. The Environment Agency's powers to carry out flood defence apply to main river only. The riparian landowner is ultimately responsible for the maintenance of the watercourse.
Table 9-4: Water Quality Assessment for Rivers in the Black Country

<table>
<thead>
<tr>
<th>Stretch</th>
<th>River</th>
<th>Year</th>
<th>Chemistry</th>
<th>Biology</th>
<th>Nitrates</th>
<th>Phosphates</th>
<th>RQO Compliant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atherley Jn to Pendeford Br (d/s Barnhurst WWTW)</td>
<td>Shropshire Union Canal</td>
<td>2007</td>
<td>D</td>
<td>E</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2006</td>
<td>C</td>
<td>C</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2005</td>
<td>D</td>
<td>C</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Slacky Ln Br. To Conf. Ford Bk (d/s Goscote WWTW)</td>
<td>Rough Brook</td>
<td>2007</td>
<td>C</td>
<td>-</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2006</td>
<td>C</td>
<td>-</td>
<td>6</td>
<td>6</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2005</td>
<td>D</td>
<td>-</td>
<td>6</td>
<td>6</td>
<td>✓</td>
</tr>
<tr>
<td>L.Gornal Outfall To Bobs/Holbeche Bk (d/s Lower Gornal WWTW)</td>
<td></td>
<td>2007</td>
<td>E</td>
<td>-</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2006</td>
<td>E</td>
<td>-</td>
<td>6</td>
<td>6</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2005</td>
<td>E</td>
<td>-</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Junction Of Arms - Bescot To Sandwell Pk (d/s Ray Hall WWTW)</td>
<td></td>
<td>2007</td>
<td>E</td>
<td>E</td>
<td>5</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2006</td>
<td>E</td>
<td>E</td>
<td>5</td>
<td>6</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2005</td>
<td>E</td>
<td>E</td>
<td>5</td>
<td>6</td>
<td>✓</td>
</tr>
<tr>
<td>Roundhill Stw To Cookley Road Br (d/s Roundhill WWTW)</td>
<td>Gallows Bk, River Stour</td>
<td>2007</td>
<td>B</td>
<td>D</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2006</td>
<td>B</td>
<td>D</td>
<td>6</td>
<td>6</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2005</td>
<td>B</td>
<td>D</td>
<td>6</td>
<td>6</td>
<td>✓</td>
</tr>
<tr>
<td>Walsall Wood Stw to Conf. Rough Bk (d/s Walsall Wood WWTW)</td>
<td>Ford Bk</td>
<td>2007</td>
<td>E</td>
<td>E</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2006</td>
<td>E</td>
<td>E</td>
<td>6</td>
<td>6</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2005</td>
<td>E</td>
<td>E</td>
<td>6</td>
<td>6</td>
<td>✓</td>
</tr>
<tr>
<td>Westacre Willenhall To Conf. Ford Bk (d/s Willenhall WWTW)</td>
<td>River Tame (Wolverhampton Arm)</td>
<td>2007</td>
<td>E</td>
<td>-</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2006</td>
<td>E</td>
<td>-</td>
<td>4</td>
<td>5</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2005</td>
<td>D</td>
<td>-</td>
<td>4</td>
<td>5</td>
<td>✓</td>
</tr>
<tr>
<td>Cont Wom Bk To Conf Bobs Bk (d/s Wombourne WWTW)</td>
<td>Sمست Bk</td>
<td>2007</td>
<td>C</td>
<td>C</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2006</td>
<td>C</td>
<td>C</td>
<td>6</td>
<td>6</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2005</td>
<td>C</td>
<td>C</td>
<td>6</td>
<td>6</td>
<td>✓</td>
</tr>
</tbody>
</table>

Table 9-4 shows that, in general, water quality is poor downstream of the WwTWs. The GQA grades confirm that overall chemical quality (for BOD, Ammonia and Dissolved Oxygen (DO)) and biological quality range between ‘fairly good’ and ‘poor’. However, all river stretches were compliant with River Quality Objectives during the reporting periods.

Nutrient concentrations are high in all watercourses, which could be attributed to the industrial nature of the catchment, poor quality urban runoff and the number of WwTWs discharging into the catchment.

9.3 Water Framework Directive (WFD)

9.3.1 WFD Introduction

The Water Framework Directive (WFD) was passed into UK law in 2003. The competent authority responsible for its implementation is the EA in England and Wales. The overall requirement of the directive is that all water bodies in the UK must achieve “good ecological and good chemical status” by 2015 unless there are grounds for derogation.

The WFD will for the first time combine water quantity and water quality issues together. The directive combines previous water legislation and in certain areas strengthens existing legislation. An integrated approach to the management of all freshwater bodies, groundwaters, estuaries and coastal waters at the river basin...
level will be adopted. Involvement of stakeholders is seen as key to the success in achieving the tight timescales and objectives set by the directive. The WFD states that all countries in the European Union have to:

- prevent deterioration in the classification status of aquatic ecosystems, protect them and improve the ecological condition of waters;
- aim to achieve at least good status for all waters. Where this is not possible, good status should be achieved by 2021 or 2027;
- promote sustainable use of water as a natural resource;
- conserve habitats and species that depend directly on water;
- progressively reduce or phase out releases of individual pollutants or groups of pollutants that present a significant threat to the aquatic environment;
- progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants; and
- contribute to mitigating the effects of floods and droughts.

The water environment within England and Wales has been divided into units called ‘water bodies’ and designated as rivers, lakes, estuaries, the coast or groundwater. Some water bodies have been designated as artificial or heavily modified if they are substantially modified or created for water supply, urban purposes, flood protection and navigation. This designation is important because it recognises their uses, whilst making sure that ecology is protected as far as possible. All water bodies will be designated a status. For surface waters, the status has an ecological and a chemical component; Ecological status is measured on the scale high, good, moderate, poor and bad; and good chemical status as pass or fail. For groundwater, good status has a quantitative and a chemical component, which together provide a single final classification: good or poor status. Good ecological status is defined as a slight variation from undisturbed natural conditions, but artificial and heavily modified waters are not able to achieve natural conditions. Instead the target for these waters is good ecological potential. This is also measured on the scale high, good, moderate, poor and bad. The chemical status of these water bodies is measured in the same way as natural water bodies.

Standards are being developed with which to measure status covering a range of criteria including water quality, biological quality, and morphology. As stated, the aim is for all water bodies to reach ‘good status’ or higher by 2015. In order to do so, the EA are developing a series of River Basin Management Plans (RBMPs) for the major river basins in England and Wales. The draft RBMPs, which sets out detailed proposals for the next 6 years, were published on 22nd December 2008 and contain the Programme of Measures to bring about the changes necessary in order to bring the water bodies which are currently failing the required standards up to good status. The measures in the draft plans have been developed with the assistance of the River Basin Liaison Panels, and include Government and EA actions, as well as actions delivered by others. The River Liaison Panels include representatives from businesses, planning authorities, environmental organisations, agriculture, forestry, consumers, fishing bodies, ports, drainage boards and regional government, which will all have key roles to play in implementing the plan. The draft plans were the subject of a six-month consultation which closed on 22nd June 2008. The final versions of the RBMPs are due to be published in December 2009.
The draft RBMP focus on achieving the protection, improvement and sustainable use of the water environment including surface freshwaters (lakes, streams and rivers), groundwater, ecosystems such as some wetlands that depend on groundwater, estuaries and coastal waters (out to one nautical mile). The draft plans set out the proposed measures to improve water quality to the required standard and achieve the set environmental objectives. The WFD allows the EA, where costs would be disproportionate or where it isn’t technically feasible to achieve the objectives by 2015, to work on a longer timescale (to 2021 or 2027) or to set lesser objectives, provided certain conditions are met.

The WFD water quality standards are currently in draft form and will not be finalised until the RBMPs are published in December 2009. However, because the WFD requirements will largely supersede the current statutory and guideline environmental standards from 2010, it is important that the WCS considers the requirements for meeting them such that the impact of growth on future compliance with legislative requirements is understood and can be managed at an early stage in the planning.

The EA’s current system of measurement, the General Quality Assessment (GQA), shows over 70% of rivers in England and Wales are currently achieving a good standard. Under the new WFD classification system this figure falls to 23% of water bodies achieving good status. This is a result of revised standards and a larger number of standards to be assessed, in combination with a principle of ‘one-out, all-out’; i.e. a waterbody is now classed according to its lowest scoring standard. A large proportion of failures are known to be caused by one or two parameters, with phosphorus causing a significant number of failures.

On that basis, the plans in their current form would bring the number of water bodies meeting good status to 28% by 2015. Some quite substantial improvements will be masked by that apparently modest degree of achievement. Many water bodies will improve significantly, maybe even from one class to another, without yet getting to good status, and many may only fail to reach good because of perhaps one indicator in future compared with several at present.

### 9.3.2 WFD Standards

In terms of water quality standards, the EA’s current GQA programme has been very successful, particularly in assessing the impact of point source discharges on watercourses. In conjunction with the Urban Wastewater Treatment Directive (UWWTD), investment to the larger WwTWs has improved discharges considerably. There are still problems however, particularly with regards to rural sources including agricultural diffuse pollution (mainly nutrients, sediment, pesticides), smaller WwTWs, industry, urban areas and roads which can all affect water quality.

In relation to development considered in this WCS, the key concerns are water availability, quantity and quality of runoff from urban areas and roads, and discharges from domestic houses, and diffuse pollution from agriculture and rural areas. These can all have a large impact on the water environment, and are interrelated. For example, river flow can affect concentrations of substances such as nitrate. However, existing schemes do not adequately assess the impact of such sources. In particular, they do not quantify the effect on the aquatic environment.

The WFD classifies water in a different way, using new and revised environmental standards to assess whether environmental conditions are good enough to support...
appropriate aquatic life for the system in question. The Directive requires that all inland and coastal water bodies reach at least "good" status by 2015 – subject to certain exemptions, which allow alternative objectives to be set in cases where it is infeasible or disproportionately expensive to achieve good status.

From 2007 to 2009, England and Wales will continue to report results based on the GQA monitoring system, with separate indicators for biology and chemistry. In England, however, a reduced network will be used, so that resources can be re-directed to implementing the WFD monitoring programme. During this time, the existing GQA and WFD approaches will report in parallel. This will enable differences between the two approaches to be distinguished.

The status of each surface water body is judged using separate ‘Ecological classification’ and ‘Chemical classification’ systems. The overall status of the water body will be determined by whichever of these is the poorer. To achieve ‘good status’ overall, a water body must achieve both good ecological and good chemical status.

9.3.2.1 Ecological Classification

The Ecological classification system has five classes, from high through good, moderate, poor to bad, and uses biological, physico-chemical, hydromorphological and chemical assessments of status as follows:

- Biological assessment uses numeric measures of communities of plants and animals (e.g. fish and rooted plants);
- Physico-chemical assessment documents parameters such as temperature and nutrient concentrations; and
- Hydromorphological assessment to document water flow and physical habitat.

The standards will differ based on the ‘typology’ of each water body; rivers, lakes, transitional and coastal waters, groundwater. The general typology for rivers is based on alkalinity and altitude.

9.3.2.2 Nutrients

The impacts of elevated concentrations of nutrients in freshwater systems, especially phosphorus, are widely studied. The most common impact is enhanced growth of plants and algae, which can affect watercourses in several ways. River channels can become blocked, exacerbating low flow conditions; diurnal fluctuations of oxygen content in the water can occur due to respiration of macrophytes during the hours of darkness, potentially affecting fish; growths of blue-green algae can be stimulated which can cause adverse affects in animals.

For revised nutrient standards in rivers, UKTAG identified that ecological sensitivity could be related to alkalinity and altitude.

Diatoms show greater sensitivity to nutrients than macrophytes, and these were subsequently used to develop the standards shown in Table 9-5, which also includes GQA and Habitats Directive guideline values.
UKTAG recognise that the relationship between nutrients and water quality is not straightforward. Thus, it is recommended that an indication of ‘actual or potential’ biological impact is needed in addition to finding large concentrations of SRP.

Nitrate is already covered by legislation which proscribes a Statutory Limit of 50 mg NO₃⁻/l (11.3 mg NO₃-N/l) as described previously. However, these limits are largely based on protection of freshwater for the purposes of drinking water. UKTAG consider that although nitrate may have a role in eutrophication in some types of freshwaters, there is insufficient understanding for new standards or conditions. For this reason, no new standards for nitrate in water have been recommended.

One of the key objectives of the WFD is to ‘prevent deterioration of the status of all water bodies of surface water’. This states that there should be a prevention of deterioration between status classes, which applies to each water body. The status class reported for a surface water body will be dictated by the quality element worst affected by human activity. However, a ‘less stringent objective’ does not mean that:

(a) the other quality elements are permitted to deteriorate to the status dictated by the worst affected quality element; or

(b) the potential for improvement in the condition of other quality elements can be ignored.

Tighter standards under the WFD are likely to require a tightening of consents and reduction in diffuse sources.

### 9.3.3 WFD and Black Country

Past and present activities within the river catchments put pressures on the water environment. Rural land management is a source of diffuse pollution from nutrients, sediments and pesticides. Sewage treatment works and other intermittent discharges from the sewerage network also increase nutrient levels whilst these and other point sources increase the pressure from ammonia and dangerous

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53 SRP = soluble reactive phosphorus, relating to the P which is readily available for uptake by organisms
54 EU Commission, 2005
substances. Run-off and drainage from urban areas can contain a range of pollutants whilst historic mining activity has left a legacy of metal and other pollution. Abstractions from rivers and groundwaters for public water supply and to a lesser extent for industry and agriculture can impact on river flows and groundwater levels. Many rivers and lakes have been subject to some form of physical modification which have had negative impacts on habitats and wildlife.

Under the WFD, the Black Country falls within the Humber and Severn River Basin Districts (RBD). The draft Humber RBMP was published on 22 December 2008 and sets out detailed proposals for the next six years and beyond, to be refined as an iterative response model. Amongst the components of the Draft Humber RBMP is to ‘lower the impact of transport and built environments’.

The main causes of the problem have been linked to:

- Flood defences – for example with artificial river embankments;
- Housing growth, leading to pressures on water quality and water resources;
- Leaks from sewerage systems and private sewage treatment works;
- Discharge of industrial waste containing organic matter;
- Using fertilisers and pesticides in parks and gardens; and
- Run-off from roads, driveways, car parks, car washing, contaminated land.

The draft Humber RBMP also notes that: “The main responsibility for implementing measures that will contribute to lowering the impact of transport and the built environment will fall on a number of different sectors including urban and transport, the water industry and the construction industry. A significant lead will have to be provided by Local Government, particularly LPAs. The Regional Planning Body (RPB) will have a significant role to play in ensuring that the RSS and proposed Integrated Regional Strategy actively seek to endorse the requirements of the WFD and promote sustainable development across the River Basin District.” (EA, 2008).

A description of the main catchments in the Black Country are taken from the respective WFD draft RBMP’s in Box 9.1 and Box 9.2.
Box 9.1 Description of catchments in the Black Country from the draft Severn RBMP

<table>
<thead>
<tr>
<th>Worcestershire Middle Severn Catchment (Severn RBD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“The Worcestershire Middle Severn catchment is predominantly rural, but contains significant urban areas including parts of Telford, Wolverhampton, Dudley, Kidderminster and Worcester. As well as the River Severn itself, the main watercourses are the rivers Worfe, Stour and Salwarpe which are subject to unsustainable levels of abstraction at low flows. The area has many water dependent sites protected for their biodiversity and designated Sites of Special Scientific Interest. There are also two Special Areas of Conservation (SAC).</td>
</tr>
<tr>
<td>Proposed actions to tackle the issues in the catchment include improvements to discharges at a number of sewage treatment works to reduce inputs of ammonia and phosphorus, the provision of advice to farmers to reduce the levels of nutrients and sediments entering watercourses and various actions to improve the management of water resources. There are also a number of investigations ongoing to assess the impacts of abstraction on the environment.</td>
</tr>
<tr>
<td>Currently 10km (2%) of river length assessed in this catchment are achieving good ecological status or potential. The elements most commonly preventing good status in all water bodies by 2015 are phosphorus and invertebrates. 48km (9%) of river has yet to be assessed.”</td>
</tr>
</tbody>
</table>

**Source:** EA, 2008
Box 9.2 Description of catchments in the Black Country from the draft Humber RBMP

<table>
<thead>
<tr>
<th>Tame, Anker and Mease Catchment (Humber RBD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“This area includes the Rivers Tame, Anker, Mease, Sence, Rea, Cole and Blythe and the Trent from its confluence with the River Tame to the River Dove. The rivers pass through the urban areas of Birmingham, Solihull, Nuneaton, Tamworth and Burton-on-Trent. Heavy industry in the area has declined over recent years but pockets remain in urban areas. To the east and the north much of the land outside the Birmingham conurbation is used for agriculture, particularly arable farming. Due to the highly urbanised nature of a large part of the catchment the largest inputs to the system come from sewage treatment works. During low flow periods a large proportion of the river flows are made up of these discharges. By far the largest input comes from Minworth Sewage Treatment Works (STW) which discharges treated effluent from Birmingham into the River Tame at Water Orton. As the water supply for Birmingham comes from the Severn catchment the Tame catchment is a net importer of water. Water pumped from quarries constitutes the second largest input of water into the catchment. Discharges from other sources make up very little of the total volume in comparison to these two contributors. However discharges of trade effluent, cooling water, effluent from a fish hatchery and treated minewater also make up river flow. Many collieries have closed in recent years due to the decline in coal mining which means that minewater needs to be carefully managed, particularly in the South Derbyshire and Warwickshire coalfields. Water quality has improved in recent years. This is a result of investments to improve sewage works and a reduction in the number of combined sewer overflows in addition to tighter regulations on discharges. The major use of water in the Burton area is for brewing, mineral washing, cooling water and dust suppression are also purposes for which water is abstracted within the catchment. These reflect the number of quarries, particularly for gravel, in the catchment and the occurrence of power stations along the Trent. Poor water quality has been the main impact on the fisheries in the River Tame for the last century. Parts of the River Tame (downstream of the River Rea), the River Blythe and the River Cole are designated as Cyprinid Fisheries. Six miles of the River Sence are managed as a trout fishery. Adult salmon are currently returning to the River Dove at the downstream end of this section of the Trent so flows are important to stimulate and facilitate this migration. This whole catchment is a very important angling leisure resource for the highly populated area which it serves, including the thousands of anglers comprising some 80 or more clubs and individuals. The River Mease is a small lowland river designated as a Special Area of Conservation under the Habitats Directive as a result of the presence of bullhead (Cottus gobio), spined loach (Cobitis taenia), otters and crowfoot beds (Ranunculus). The River Blythe is a Site of Special Scientific Interest designated as a fine example of a lowland river on clay. More than 72,000 new houses are planned in the Regional Spatial Strategy for this catchment mainly in the areas around Birmingham, the Black Country, Burton and Tamworth, although these figures are still being finalised. Currently 0% of surface water bodies in this catchment are achieving either good status or potential. We are proposing that by 2015, no deterioration will take place and improvements to 49% will be made by 2027. All water bodies in this catchment have been assessed.”</td>
</tr>
</tbody>
</table>

Source: EA, 2008b

Table 9-6 provides a summary of the WFD assessment for watercourses likely to be impacted by proposed growth within the Black Country. Four of the watercourses are designated as candidate Heavily Modified Water Bodies, with the...
Black Country Authorities
Black Country Water Cycle Study and Scoping Surface Water Management Plan

Shropshire Union Canal being classed as candidate Artificial. None of the water bodies currently achieve ‘good ecological status’

None of the surface water bodies assessed as part of this catchment currently achieve ‘good ecological status’ or ‘good ecological potential’ under the WFD. Measures proposed to address this and improve water quality would still result in the majority failing by 2015, the date set by the WFD by which the water bodies should be achieving ‘good ecological status’ or ‘good ecological potential’. Biological quality and orthophosphate is generally classed as poor or bad throughout the catchment. Even with proposed measures it is unlikely that the phosphate concentrations will be sufficiently lowered by 2015 to reach ‘good ecological status’ or ‘potential’. The phosphate standards are particularly onerous and will require a range of planned and further measures and/or controls for point and diffuse sources. However, it should be noted that further investigations may be required to assess whether the higher recorded concentrations of phosphates are actually having negative impacts on the natural environment.

The current GQA water quality assessment showed that water quality within the Black Country is currently of fairly poor quality, but compliant with current river quality targets, and the WFD assessment concurs with this. However, the WFD imposes more stringent requirements on the watercourses and therefore though the majority of the watercourses are heavily modified, they still need to reach ‘good ecological improvement’ by 2015 or 2027. Assessing the impacts of future growth on river quality is particularly difficult in these circumstances. All future discharges will need to comply with the WFD’s aim to meet ‘good ecological status’ or ‘potential’ and other measures may be in place within the catchment to address existing water quality problems. It is likely that future growth at WwTWs will tighten existing consents to comply with the objectives of the WFD. This will need to be assessed as part of the Detailed WCS. Alongside this it is recommended that the Stage 2 WCS considers the overall catchment considerations for improving water quality in the Black Country area by making use of, or building on, previous water quality based modelling where available.
### Table 9-6: WFD Assessment Summary

<table>
<thead>
<tr>
<th>WB ID</th>
<th>Name of River Stretch</th>
<th>Des.</th>
<th>Current Overall Status</th>
<th>Current Ecological Status</th>
<th>Current Chemical Status</th>
<th>Biological</th>
<th>Ammonia</th>
<th>Ortho-phosphate</th>
<th>Dissolved Oxygen</th>
</tr>
</thead>
<tbody>
<tr>
<td>GB70410256</td>
<td>Shropshire Union Canal, Wolverhampton to Belvide Reservoir feeder (d/s Barnhurst WwTW)</td>
<td>cA</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>GB104028046990</td>
<td>Ford Brook from Source to River Tame (d/s Goscote &amp; Walsall Wood WwTW)</td>
<td>cHMWB</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Good</td>
<td>Poor</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Bad</td>
</tr>
<tr>
<td>GB109054044830</td>
<td>Bobs-Holbeche Bk - source to conf Smostow Bk (d/s Lower Gornal WwTW)</td>
<td>-</td>
<td>Bad</td>
<td>Bad</td>
<td>Good</td>
<td>Bad</td>
<td>Bad</td>
<td>Poor</td>
<td>High</td>
</tr>
<tr>
<td>GB104028046840</td>
<td>River Tame from Conf of two arms to R Blythe (d/s Ray Hall WwTW)</td>
<td>cHMWB</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Not Good</td>
<td>Poor</td>
<td>Moderate</td>
<td>Bad</td>
<td>Poor</td>
</tr>
<tr>
<td>GB109054044710</td>
<td>R Stour (Worcs) - conf Smostow Bk to conf R Severn (d/s Roundhill WwTW)</td>
<td>-</td>
<td>Poor</td>
<td>Poor</td>
<td>Not Good</td>
<td>Poor</td>
<td>Good</td>
<td>Bad</td>
<td>High</td>
</tr>
<tr>
<td>GB104028046930</td>
<td>R Tame (W/hampton Arm) from Source to Sneyd Brook (d/s Willenhall WwTW)</td>
<td>cHMWB</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Good</td>
<td>Poor</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Good</td>
</tr>
<tr>
<td>GB109054049340</td>
<td>Smostow Bk - source to conf Wom-Penn Bk (d/s Wombourne WwTW)</td>
<td>cHMWB</td>
<td>Moderate</td>
<td>N/A</td>
<td>Poor</td>
<td>Poor</td>
<td>Bad</td>
<td>Moderate</td>
<td></td>
</tr>
</tbody>
</table>
9.3.4 WFD and Water Company Planning

An important consideration in the WFD planning process is the timing with respect to the statutory water company planning and funding process. At present, there is a discrepancy between the two planning timelines. The RBMPs are not due to be finalised until December 2009 and therefore the Programme of Measures which sets out what changes will need to be implemented in order to achieve ‘good’ status in all water bodies, will not be known until this point. Whilst it is not just water companies which will be affected by the Programme of Measures, it is considered that water companies such as ST will have a key role to play in implementing the measures and helping to achieve ‘good’ status in time for the 2015 deadline as required by the WFD, or by 2027 as identified by the RBMP.

However, the current PR09 and AMP5 timelines are such that the water companies have already submitted their final BPs, which set out the investment requirements for AMP5 (2010-2015), well before the RBMPs plans are finalised. It is therefore uncertain how much of the investment required to meet with Programme of Measures can be planned for and funded in the next AMP period and that much of the investment required to meet good status may not be forthcoming until AMP6 (2015-2020).

Despite this, studies such as the WCS have a role to play in identifying likely impacts of the WFD and where future investment is most likely to be required in order to move key water bodies towards good status based on the interim risk characterisations. Use of the draft standards and draft risk characterisations is essential such that early decisions can be taken on where investment is most likely to be required in order to meet with the future programme of measures and attainment of ‘good’ status. In this respect, the Black Country WCS can highlight and provide justification for further investment to be included in ST’s future funding submissions to OFWAT.

9.4 Water Quality Summary

- Water quality within the Black Country has been assessed downstream of the eight WwTWs as these watercourses are most likely to be impacted by proposed growth within the study area. The water quality has been assessed against current water quality objectives and future WFD targets;

- In general, water quality within the Black Country area is of fairly poor quality but has complied with current water objectives over the latest Environment Agency reporting periods;

- Four of the eight watercourses are candidate Heavily Modified Water Bodies and one is candidate Artificial and are therefore required to reach ‘good ecological potential’ by 2015;

- None of the watercourses are currently achieving ‘good ecological status’ or ‘good ecological potential’ under the WFD, with biological and Orthophosphate frequently being assessed as poor or bad;

- A detailed water quality assessment will need to be undertaken as part of the Detailed WCS to assess the impacts of proposed growth on downstream water quality.
10 Ecology and Biodiversity

10.1 Introduction

In devising solutions for a WCS it is essential that impacts and effects upon features of biodiversity importance is considered. In particular, WCSs should also be compliant with the requirements of the Conservation (Natural Habitats &c) Regulations 1994 (as amended 2007), which interprets the EU Habitats Directive into English & Welsh law.

Box 10.1 The legislative basis for “appropriate assessment”

<table>
<thead>
<tr>
<th>Habitats Directive 1992</th>
</tr>
</thead>
<tbody>
<tr>
<td>Article 6 (3) states that:</td>
</tr>
<tr>
<td>“Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site’s conservation objectives.”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conservation (Natural Habitats &amp;c. Regulations) 1994 (amended 2007)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulation 48 states that:</td>
</tr>
<tr>
<td>“A competent authority, before deciding to … give any consent for a plan or project which is likely to have a significant effect on a European site … shall make an appropriate assessment of the implications for the site in view of that sites conservation objectives…The authority shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the European site”</td>
</tr>
</tbody>
</table>

The Regulations require land use plans to take steps through a process known as Habitat Regulations Assessment (HRA) to ensure that a policy framework exists to ensure that their implementation will not result in adverse effects (either alone or in combination with other plans and projects) on internationally designated wildlife sites, specifically Special Protection Areas (SPA), Special Areas of Conservation (SAC) and, as a matter of UK Government policy, sites designated under the Convention on Wetlands of International Importance 1979 (‘Ramsar sites’).

Since WCSs inform Core Strategies and other DPDs it is essential that the WCS takes account of the thresholds above or below which damage to international wildlife sites will occur when devising abstraction or effluent discharge solutions.

It is understood that ST are undertaking an HRA of their WRMP and this will be a crucial piece of information to draw on for any future study as and when it is complete and made available.

10.2 Methodology

In practice, HRA of projects can be broken down into three discrete stages, each of which effectively culminates in a test. The stages are sequential, and it is only necessary to progress to the following stage if a test is failed. The stages are:
10.2.1 Stage 1 – Likely Significant Effect Test

This is essentially a risk assessment, typically utilising existing data, records and specialist knowledge. The purpose of the test is to decide whether ‘full’ Appropriate Assessment is required. The essential question is:

"Is the project, either alone or in combination with other relevant projects and plans, likely to result in a significant adverse effect upon European sites?"

If it can be demonstrated that significant effects are unlikely, no further assessment is required.

10.2.2 Stage 2 – Appropriate Assessment

If it cannot be satisfactorily demonstrated that significant effects are unlikely, a full “Appropriate Assessment” will be required. In many ways this is analogous to an Ecological Impact Assessment, but is focussed entirely upon the designated interest features of the European sites in question. Bespoke survey work and original modelling and data collation are usually required. The essential question here is:

“Will the project, either alone or in combination with other relevant projects and plans, actually result in a significant adverse effect upon European sites, without mitigation?”

If it is concluded that significant adverse effects will occur, measures will be required to either avoid the impact in the first place, or to mitigate the ecological effect to such an extent that it is no longer significant. Note that, unlike standard Ecological Impact Assessment (EIA), compensation for significant adverse effects (i.e. creation of alternative habitat) is not permitted at the Appropriate Assessment stage.

10.2.3 Stage 3 – Imperative Reasons of Overriding Public Interest (IROPI) Test

If a project will have a significant adverse effect upon a European site, and this effect cannot be either avoided or mitigated, the project cannot proceed unless it passes the IROPI test. In order to pass the test it must be objectively concluded that no alternative solutions exist. The project must be referred to Secretary of State on the grounds that there are Imperative Reasons of Overriding Public Interest as to why the plan should nonetheless proceed. The case will ultimately be decided by the European Commission.

This report deals with the first stage of HRA – the Likely Significant Effect Test. It also takes the opportunity to consider adverse effects on other statutory sites55 and non-statutory County Wildlife Sites.

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55 Statutory site: Wildlife sites designated under national legislation, specifically the National Parks & Access to the Countryside Act 1949 and Wildlife & Countryside Act 1981 (as amended). These are Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR) and Local Nature Reserves (LNR)
10.3 Issue for Consideration: Treated effluent discharge

The Black Country falls within the Humber (via the River Trent) and Severn River Basin Districts and the Humber and Severn estuaries will therefore be ultimate receiving waters for treated effluent discharged to the Rivers Trent or Severn. The estuaries of both the Humber and Severn are designated for their international wildlife importance (Sections 10.3.1 and 10.3.3, respectively). It is therefore possible that cumulative impacts may result on the receiving estuaries from development in the Black Country considered ‘in combination’ (as required by legislation) with the additional housing to be delivered across the wider West Midlands, East Midlands, Yorkshire and Humber regions under their respective Regional Spatial Strategies.

Work to inform the Habitat Regulations Assessment of Phase 2 of the West Midlands RSS\textsuperscript{56} identified that adverse effects of effluent discharge on the Severn Estuary cSAC, SPA and Ramsar site could not be ruled out and stated that there was a need for a precautionary policy required until the results of the Review of Consents & Water Framework Directive (WFD)/Restoring Sustainable Abstraction (RSA) Sensitivity Analysis can be made available to the statutory nature conservation bodies. As such, development in the Black Country may contribute cumulatively to adverse effects on the Severn Estuary, if the River Severn is utilised for effluent discharge. This issue would require further investigation and liaison with both the EA and NE. Although the Humber Estuary SAC and associated SPA were not specifically identified within the RSS evaluation work as being of concern, this should also be investigated and confirmed for the WCS.

10.3.1 Humber Estuary SAC

The Humber is the second-largest coastal plain estuary in the UK, and the largest coastal plain estuary on the east coast of Britain. It is a muddy, macro-tidal estuary, fed by the Rivers Ouse, Trent and Hull, Anholme and Graveney. The concentrations of suspended sediment concentrations are large, being derived from a variety of sources, including marine sediments and eroding Boulder Clay along the Holderness coast. This is the northernmost of the English east coast estuaries whose structure and function is intimately linked with soft eroding shorelines. Upstream from the Humber Bridge, the navigation channel undergoes major shifts from north to south banks, for reasons that have yet to be fully explained. This section of the estuary is also noteworthy for extensive mud and sand bars, which in places form semi-permanent islands.

The site is designated as an SAC for:

- Estuaries;
- Mudflats and sandflats not covered by seawater at low tide;
- Sandbanks which are slightly covered by sea water all the time;
- Coastal lagoons;
- Salicornia and other annuals colonising mud and sand;

\textsuperscript{56} Treweek Environmental Consultants. 2009. Impact of Housing Growth on Water Supply and Water Quality at European sites – Update to information contained within the West Midlands RSS Phase II Revision HRA
• Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*);
• Embryonic shifting dunes;
• Shifting dunes along the shoreline with *Ammophila arenaria* (‘white dunes’);
• Fixed dunes with herbaceous vegetation (‘grey dunes’);
• Dunes with *Hippophae rhamnoides*;
• Sea lamprey;
• River lamprey; and
• Grey seal.

During the 2007 Condition Assessment Process 94% of the SPA was found to be in favourable condition, with the remainder recovering.

### 10.3.2 Humber Flats, Marshes and Coast SPA and Ramsar site

The site is designated as an SPA for:

- During the breeding season:
  - Little Tern *Sterna albifrons*, 63 pairs representing at least 2.6% of the breeding population in Great Britain
  - Marsh Harrier *Circus aeruginosus*, 11 pairs representing at least 6.9% of the breeding population in Great Britain (Count as at 1995)

- Over winter:
  - Bar-tailed Godwit *Limosa lapponica*, 1,593 individuals representing at least 3.0% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6)
  - Bittern *Botaurus stellaris*, 2 individuals representing at least 2.0% of the wintering population in Great Britain (5 year mean 91/2-95/6)
  - Golden Plover *Pluvialis apricaria*, 29,235 individuals representing at least 11.7% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6)
  - Hen Harrier *Circus cyaneus*, 20 individuals representing at least 2.7% of the wintering population in Great Britain (5 year peak mean 1984/5-1988/9)
  - Dunlin *Calidris alpina alpina*, 23,605 individuals representing at least 1.7% of the wintering Northern Siberia/Europe/Western Africa population (5 year peak mean 1991/2 - 1995/6)
  - Knot *Calidris canutus*, 33,848 individuals representing at least 9.7% of the wintering Northeastern Canada/Greenland/Iceland/Northwestern Europe population (5 year peak mean 1991/2 - 1995/6)
  - Redshank *Tringa totanus*, 4,452 individuals representing at least 3.0% of the wintering Eastern Atlantic - wintering population (5 year peak mean 1991/2 - 1995/6)
Shelduck *Tadorna tadorna*, 4,083 individuals representing at least 1.4% of the wintering Northwestern Europe population (5 year peak mean 1991/2 - 1995/6)

- On passage:
  - Redshank *Tringa totanus*, 5,212 individuals representing at least 2.9% of the Eastern Atlantic - wintering population (5 year peak mean 1991/2 - 1995/6)
  - Sanderling *Calidris alba*, 1,767 individuals representing at least 1.8% of the Eastern Atlantic/Western & Southern Africa - wintering population (2 year mean May 1993 - 1994)


As well as its bird assemblage, the Humber Estuary is designated as a Ramsar site for:

- The site is a representative example of a near-natural estuary with the following component habitats - dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons;
- The Humber Estuary supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast. The dune slacks at Saltfleetby-Theddlethorpe on the southern extremity of the Ramsar site are the most north-easterly breeding site in Great Britain of the natterjack toad *Bufo calamita*.
- The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.

### 10.3.3 Severn Estuary SPA and Ramsar Site

The Severn Estuary is designated as being of European importance due to populations of the following species:

- Over winter:
  - Bewick’s Swan *Cygnus columbianus bewickii*, 280 individuals representing at least 4.0% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6)
  - Curlew *Numenius arquata*, 3,903 individuals representing at least 1.1% of the wintering Europe - breeding population (5 year peak mean 1991/2 - 1995/6)
  - Dunlin *Calidris alpina alpina*, 44,624 individuals representing at least 3.2% of the wintering Northern Siberia/Europe/Western Africa population (5 year peak mean 1991/2 - 1995/6)
  - Pintail *Anas acuta*, 599 individuals representing at least 1.0% of the wintering Northwestern Europe population (5 year peak mean 1991/2 - 1995/6)
- Redshank Tringa totanus, 2,330 individuals representing at least 1.6% of the wintering Eastern Atlantic - wintering population (5 year peak mean 1991/2 - 1995/6)
- Shelduck Tadorna tadorna, 3,330 individuals representing at least 1.1% of the wintering Northwestern Europe population (5 year peak mean 1991/2 - 1995/6)
- On passage (mid-March to early May and from July onwards):
  - Ringed Plover Charadrius hiaticula, 655 individuals representing at least 1.3% of the Europe/Northern Africa - wintering population (5 year peak mean 1991/2 - 1995/6)


The species-poor invertebrate community includes high densities of ragworms, lugworms and other invertebrates forming an important food source for passage and wintering waders. The site is of importance during the spring and autumn migration periods for waders moving up the west coast of Britain, as well as in winter for large numbers of waterbirds, especially swans, ducks and waders.

The Severn Estuary also qualifies as a Ramsar site on six of the nine Ramsar criteria:

<table>
<thead>
<tr>
<th>Ramsar Criterion</th>
<th>Description of Criterion</th>
<th>Severn Estuary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.</td>
<td>Due to immense tidal range (second-largest in world), this affects both the physical environment and biological communities.</td>
</tr>
<tr>
<td>3</td>
<td>A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.</td>
<td>Due to unusual estuarine communities, reduced diversity and high productivity.</td>
</tr>
<tr>
<td>4</td>
<td>A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.</td>
<td>This site is important for the run of migratory fish between sea and river via estuary. Species include Salmon Salmo salar, sea trout S. trutta, sea lamprey Petromyzon marinus, river lamprey Lampetra fluviatilis, allis shad Alosa alosa, twaite shad A. fallax, and eel Anguilla anguilla. It is also of particular importance for</td>
</tr>
</tbody>
</table>
**Ramsar Criterion** | **Description of Criterion** | **Severn Estuary**
--- | --- | ---
5 | A wetland should be considered internationally important if it regularly supports assemblages of waterbirds of international importance. | migratory birds during spring and autumn. 70919 waterfowl (5 year peak mean 1998/99-2002/2003)
6 | A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird. | The Severn Estuary supports more than 1% of the population of Tundra swan, Greater white-fronted goose, shelduck, Gadwall, Dunlin, Common redshank, Lesser black-backed gull Ringed plover, teal and pintail.
8 | A wetland should be considered internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend. | The fish of the whole estuarine and river system is one of the most diverse in Britain, with over 110 species recorded. Numerous scarce species use the Severn Estuary as a key migration route to their spawning grounds in the many tributaries that flow into the estuary. The site is important as a feeding and nursery ground for many fish species, particularly allis shad *Alosa alosa* and twaite shad *A. fallax* which feed on mysid shrimps in the salt wedge.

### 10.3.4 Severn Estuary Candidate SAC

The Severn Estuary is also designated as a cSAC for supporting significant populations of the following habitats and non-avian species:

- Estuaries
- Mudflats and sandflats not covered by seawater at low tide
- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- Sandbanks which are slightly covered by sea water all the time
- Reefs
- Sea lamprey *Petromyzon marinus*
- River lamprey *Lampetra fluviatilis*
- Twaite shad *Alosa fallax*

Glassworts and annual sea-bite colonise the open mud, with beds of all three species of eelgrass *Zostera* occurring on more sheltered mud and sandbanks. Large expanses of common cord-grass also occur on the outer marshes. Heavily grazed saltmarsh fringes the estuary with a range of saltmarsh types present. The middle marsh sward is dominated by common saltmarsh-grass with typical associated species. In the upper marsh, red fescue and saltmarsh rush become more prominent.
10.4 Issue for Consideration: Abstraction from Local Sources

Work to inform the HRA of Phase Two of the West Midlands RSS\(^{57}\) identified that adverse effects of abstraction for the Public Water Supply on the Severn Estuary cSAC, SPA and Ramsar site could not be ruled out and stated that there was a need for a precautionary policy required until the results of the Review of Consents and WFD/RSA Sensitivity Analysis can be made available to the statutory nature conservation bodies. As such, development in the Black Country may contribute cumulatively to adverse effects on the Severn Estuary if the River Severn is utilised as a source for water supply. This issue would require further investigation and liaison with both the EA and NE, although any evaluation will need to take account of the availability of the Shropshire Groundwater Scheme (see section 4.4.1.3) to supplement flows in the Severn and compensate for any reduction in levels due to increased abstractions.

In addition to internationally designated wildlife sites, Blithfield Reservoir in Staffordshire (which forms part of the water supply system for the Black Country, see section 4.4.1.2) is a Site of Special Scientific Interest and impacts from any increase in abstraction from, or capacity of, the wildlife interest of the reservoir would need to be accounted for in the WCS. Blithfield Reservoir is Staffordshire’s largest area of standing water, situated in the valley of the River Blithe, between Stafford and Burton-upon-Trent. The site is a nationally important for goosander Mergus merganser, regularly supporting more than 1% of the total British wintering population. The peak wintering waterfowl numbers exceed those for all other Staffordshire water bodies and is second only to Rutland Water (Leicestershire) for inland waters in the Midlands region. Furthermore, the reservoir and its woodland and farmland surroundings is an important wintering locality for an outstanding variety of birds.

In addition, any connection between SSSIs and the Sherwood Sandstone Aquifer of the Staffordshire Basin which is a major source of water supply for the Black Country would need to be investigated as part of the WCS. In particular, it would be necessary to ensure that increased abstraction from this aquifer would not lead to damaging drawdown from those SSSIs which are hydrologically linked to the aquifer.

The Review of Consent process (see section 4.5.5) contains details of a number of groundwater sources operated by SSW in South Staffordshire, where reductions in DO may be required. ST also has a number of sites under investigation and they have made a commitment not to include any new resource options which may impact on those sites under investigation.

10.5 Issue for Investigation: Abstraction from Non-Local Resources

A significant proportion of the public water supply to the West Midlands arises from sources in Wales. There has been considerable debate during the preparation of the WMRSS over adverse impacts of any increase in abstraction from Welsh sources. This mainly concerns water supply for Herefordshire rather than the Black Country, but the matter should be clarified as part of the Detailed WCS.

\(^{57}\) Treweek Environmental Consultants. 2009. Impact of Housing Growth on Water Supply and Water Quality at European sites – Update to information contained within the West Midlands RSS Phase II Revision HRA
11 Water Cycle - Overview of Constraints

Following the assessment of each of the water cycle and water environment topic areas in proceeding sections, this Section presents an overall summary of impacts and limitations to development up to 2026. The constraints relating to each development area are presented in Table 11.1 to give a visual assessment of issues pertaining to each development area in the Black Country. This is based on a colour coding system. In addition, a summary of main constraints and issues that need to be addressed are discussed.

In general, it can be seen that the main issues relate to potential impact to the water environment, in this case from increases in discharges from WwTWs. However, this needs to be considered against the existing water quality targets and draft RBMP targets. Any opportunity to consider wider Programme of Measures (POMS) in the region to improve the water environment should be considered. Water environment issues in the Black Country are many and varied, and each sector needs to bare a fair share of the burden to achieve proscribed objectives.

Water resources could be a significant issue, mainly in ST’s Water Resource Zone (WRZ) 3. The situation for SSW appears to be more straightforward. These issues need to be considered in relation to the findings and assumptions made in Section 4.

The issues surrounding possible constraints of wastewater network need to be considered in conjunction with ST. In particular, many constraints relate to assumptions on WwTW’s which have potential to accept additional flow from multiple development areas. When assessed individually, such potential problems are likely to be minimal. Thus, more detailed modelling should be conducted to confirm this preliminary assessment.

Volumetric capacity of WwTW is unlikely to be an issue in the Black Country. Nevertheless, increasing discharges are likely to lead to pressures on some WwTW process capacities and discharge consents. This should be confirmed during any proposed Detailed WCS.

A more detailed description is provided in the following Sections.
Table 11.1 Water Cycle Constraints (2007-2026)

<table>
<thead>
<tr>
<th>Strategic centres</th>
<th>Houses</th>
<th>WwTW volumetric capacity</th>
<th>Wastewater network</th>
<th>Water resource</th>
<th>Water environment (draft WFD)</th>
<th>Flood risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC1: Wolverhampton</td>
<td>2,400</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SC2: Walsall</td>
<td>500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SC3: Brierley Hill</td>
<td>3,000</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Regeneration corridors</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RC 2 Stafford Road</td>
<td>1,380</td>
<td></td>
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<tr>
<td>RC 3 South of Wolverhampton City Centre</td>
<td>975</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>RC 4 Wolverhampton – Bilston</td>
<td>4,600</td>
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<tr>
<td>RC 6 Wednesfield/Willenhall/Darlaston</td>
<td>2,550</td>
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<tr>
<td>RC 7 Bloxwich/Birchills/Bescot</td>
<td>1,800</td>
<td></td>
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<tr>
<td>RC 8 Hill Top</td>
<td>6,070</td>
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<tr>
<td>RC 9 Tipton/Dudley Port/Brades Village</td>
<td>6,150</td>
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<tr>
<td>RC 10 Pensnett/Kingswinford</td>
<td>735</td>
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<tr>
<td>RC 11 Dudley/Brierley Hill – Stourbridge</td>
<td>5,125</td>
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<tr>
<td>RC 12 Oldbury/West Bromwich/Smethwick</td>
<td>3,670</td>
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</tr>
<tr>
<td>RC 13 Rowley Regis – Jewellery Line</td>
<td>6,800</td>
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<tr>
<td>RC 14 Coombs Wood – Halesowen</td>
<td>500</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>RC 15 Brownhills</td>
<td>640</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RC 16 Coseley – Tipton – Princes End</td>
<td>2,535</td>
<td></td>
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</tr>
</tbody>
</table>

Key

- **Spare capacity, minimum investment required, minimal issues.**
- **Strategic scale mitigation or water cycle infrastructure will be required.**
- **Major investment required / major limitation**

11.1 Water Resources and Supply

ST’s draft WRMP indicates a supply/demand shortfall within the Severn WRZ (3) over the entire planning period through to 2035.

As a result, ST is now proposing resources schemes (mainly groundwater) and demand management measures within this WRZ. The precise timing of these schemes will be included in the final WRMP.

The SSW’s draft WRMP shows only modest changes to various components of the supply/demand balance. Overall, the Company has sufficient resources to meet the forecast growth in demand plus target headroom for both the annual average and peak week conditions throughout the plan period to 2035. The surplus of resources means that there is no
requirement for either supply-side or demand-side interventions other than those included in their draft WRMP. Demand management measures are therefore all that will be required by SSW.

This healthy situation means that those parts of Black Country supplied by SSW i.e. Walsall, Dudley and Sandwell should all have sufficient resources to meet the planned growth for these areas. However, these assumptions are subject to the risks to water supplies as outlined in Section 4.5.5.

Scott Wilson’s initial assessment of the potential benefits from adopting a Water Neutrality position on all future residential development within the Black Country would indicate that it is a realistically achievable target for the Black Country Authorities to aim for in its WCS. In order to achieve this would require the 332,000 currently unmetered households to reduce their water consumption to rates equivalent to just above the level required in order for dwellings to meet the CSH Standard Level 1/2 (i.e. around 120 lh⁻¹ d⁻¹).

11.2 Flood Risk, SUDS and Surface Water Management

The heavily urbanised nature of the Black Country and its corresponding high level of impermeable surfaces, the extensive network of culverted rivers, and steep sided valleys, result in a high susceptibility to localised surface water flooding during periods of intense rainfall.

As emphasised in the register of historical flood incidents, there are many potential causes for surface water flooding in the Black Country. Furthermore, these flood sources are often interlinked, thus exacerbating surface water runoff.

Flood risk issues in the Black Country are widely dispersed. With no particular flooding “hot spots” identified in the Black Country, perhaps with the exception of the Oxley Brook in Wolverhampton and the M6 culvert in Sandwell, determining the appropriate scale and method of urban pluvial modelling will be a challenge.

- Dudley MBC includes the towns and urban areas of Dudley itself, Stourbridge, Halesowen, Kingswinford, Brierley Hill and Sedgley / Coseley. Generally, Dudley MBC is located on higher grounds, hence fluvial flooding is not a significant issue.
- Sandwell MBC is almost entirely urban. It is centred on West Bromwich and includes the towns of Wednesbury, Tipton and Oldbury. The borough lies at the upstream end of both River Severn and River Tame catchments. Fluvial flooding is therefore not critical in this area.
- Walsall MBC includes the urban areas of Walsall, Brownhills, Aldridge, Bloxwich, Willenhall and Darlaston.
- The City of Wolverhampton (WCC) occupies much of the borough (with the town of Bilston in the south west corner) and is heavily urbanised. It lies on the western side of the Birmingham plateau some 122 metres above sea level. Most of the borough lies in the headwaters of the Stour and Tame catchments (western and eastern parts, respectively), whilst the northern edge of the borough drains into the River Penk.
Dudley, Sandwell and Wolverhampton receive very little drainage from adjacent boroughs, being located at the upper end of their catchments. Therefore these Councils need to be aware of the downstream impact that development will place on the river and drainage systems, as well as the corresponding downstream communities.

The current scoping study has identified that there is significant potential for groundwater flooding within the Black Country area. Anecdotal evidence suggests that historic groundwater flooding has occurred within the WCC administrative area. In addition, concerns regarding the potential for groundwater flooding in the Sandwell MBC and Dudley MBC areas have also been raised.

A full assessment of flooding and surface water management is provided in Sections 6 and 7.

11.3 Wastewater Treatment and Collection

For the purposes of the Outline WCS, ST did not provide information pertaining to the ‘process capacity’ at the WwTWs. Process capacity refers to the amount of flow that can be treated to the required quality standards as set under the discharge consent. Therefore, it has been agreed that the headroom capacity at the WwTW is calculated from the volumetric capacity (i.e. the difference between the maximum dry weather flow (DWF) that ST are permitted to discharge under the discharge consent and the current DWF that is treated from the existing population). This is based on the assumption that ST would seek the funding required to upgrade the processes in the works (if necessary) to treat the additional flow to the standard required under the existing licence.

Process capacity, discharge consents and potential impacts to the receiving watercourses would need to be assessed in any proposed Detailed WCS.

Eight WwTWs have been identified as being likely to be impacted by growth in the study area.

- Barnhurst WwTW has an estimated volumetric capacity to allow the WwTW to treat flow from around 67,900 new homes before an upgrade or new WwTW will be required.
- Goscote WwTW has an estimated volumetric capacity to treat flow from around 19,000 new homes before an upgrade or new WwTW will be required.
- Lower Gornal WwTW has an estimated volumetric capacity to treat flow from around 7,700 new homes before an upgrade or new WwTW will be required.
- Ray Hall WwTW has an estimated volumetric capacity to treat flow from around 119,300 new homes before an upgrade or new WwTW will be required.
- Roundhill WwTW has an estimated volumetric capacity to treat flow from around 32,860 new homes before an upgrade or new WwTW will be required.
- Walsall Wood WwTW has an estimated volumetric capacity to treat flow from around 2,515 new homes before an upgrade or new WwTW will be required.
- Willenhall WwTW has an estimated volumetric capacity to treat flow from around 18,256 new homes before an upgrade or new WwTW will be required.
• Wombourne WwTW has an estimated volumetric capacity to treat flow from around 8,243 new homes before an upgrade would be required.

Limited information was available on WwTW catchments, and assumptions were made on the areas served by each works, as detailed in Section 8. It has been tentatively concluded that housing targets can be accommodated by the existing volumetric capacity of the relevant WwTW.

A preliminary assessment of process capacity and impacts on watercourses was conducted. WwTW Consents are likely to require tightening to meet the proposed WFD water quality standards under current conditions. Works that are currently treating effluent close to BAT i.e. Barnhurst WwTW have less capacity to treat further effluent flow to a tighter standard and therefore may need to seek alternative treatment options to deal with increased effluent discharges as a result of proposed development in the Black Country.

The urban nature of the Black Country means that there is a good coverage of existing strategic sewers across the study area. However, any upgrades to the existing sewer network are likely to need to pass through already developed areas which can be relatively expensive and the timescales for delivery of this could be relatively long.

Key strategic upgrades are likely to be required to deliver the significant development in RC8, RC9, RC12 and RC16 (as defined in Table 3-4). These will feed into the same sewer network which drains to Ray Hall WwTW and therefore development within these areas will need to be assessed in combination through a detailed modelling exercise to determine existing capacity within the sewer network serving these areas and the potential to accommodate the proposed development.

A significant volume of development is planned for RC11, RC13 and RC14 which will feed into the sewer network that drains to Roundhill WwTW. Key strategic upgrades are likely to be required to deliver development in these areas. The areas which feed into sewer network that drains to Roundhill WwTW will also need to be assessed in similar fashion to that mentioned above.

The Strategic Centre of Brierley Hill is likely to require key strategic upgrades to the sewer network to deliver the proposed development.

11.4 Water Environment

In general, water quality is poor downstream of the WwTWs. The GQA grades confirm that overall chemical quality (for BOD, Ammonia and Dissolved Oxygen (DO)) and biological quality ranges between ‘fairly good’ and ‘poor’. However, all river stretches were compliant with River Quality Objectives during the reporting periods.

Nutrient concentrations are high in all watercourses, which could be attributed to the industrial nature of the catchment, poor quality urban runoff and the number of WwTWs discharging into the catchment.

None of the surface water bodies assessed as part of this catchment currently achieve ‘good ecological status’ or ‘good ecological potential’ under the WFD. Assessing the impacts of future
growth on river quality is particularly difficult in these circumstances. All future discharges will need to comply with the WFD’s aim to meet ‘good ecological status’ or ‘potential’ and other measures may be in place within the catchment to address existing water quality problems. It is likely that future growth at WwTWs will require tightened consents to comply with the objectives of the WFD. This will need to be assessed as part of the Detailed WCS.

Due to the scale of the Black Country, it is not possible to give a quantitative assessment of the water quality in each watercourse. In common with previous WCS Studies, Section 9 assessed the potential impacts to water quality from potentially the most significant risk; downstream of WwTWs. In Table 11.1, the water quality status, as assessed by the draft WFD Classification, was ascribed to the development areas by a particular WwTW. It is recognised that this method has limitations, but does allow an impact to water quality to be ascribed to a particular area.

Water Cycle Studies should be compliant with the requirements of the Conservation (Natural Habitats &c) Regulations 1994 (as amended 2007), which interprets the EU Habitats Directive into English & Welsh law. Development may lead to impacts on the Humber SAC and Severn Estuary SPA & RAMSAR site and this should be considered further, in consultation with other stakeholders, during any Detailed WCS.
12 Policy, Developer Guidance and Funding Mechanisms

12.1 Introduction

It is intended that the completed Black Country WCS will produce an overall strategy that each of the key stakeholders can sign up to. This will aid in the process of delivering development in the Black Country and local environs by helping to ensure that objections to proposed development on the grounds of water issues such as flood risk and abstraction are minimised. A completed WCS that is agreed by the Black Country Councils, ST, SSW, NE and the EA will aid developers in understanding the requirements they need to meet in order to comply with the WCS recommendations. It will also set the framework for funding water infrastructure requirements in the future.

In order to achieve this, the Black Country WCS should aim to produce the following:

- Guidance on planning policy with respect to development and the water cycle that the councils can use to input into the LDF, and guidance on incorporating the WCS findings into the Development and Flood Risk SPD;

- Guidance for developers in terms of actions to achieve compliance with the overall WCS. This will be in the form of a Developer Checklist and it is envisaged that this will eventually be a document, which if its criterion are all met for a proposed development, will help to ensure no objection from the EA or LPA on the grounds of water cycle issues. This type of checklist document has been successfully developed for other WCS such as the inaugural WCS completed for Corby. Consideration should also be given to the checklist drawn up in the SFRA;

- Agreement on funding mechanisms, particularly for strategic, development wide infrastructure required i.e. strategic scale and integrated surface water attenuation schemes, maintenance and responsibility;

- Planning timelines for provision of water infrastructure against growth to aid both ST and SSW in planning for future water and wastewater infrastructure within respective BPs;

- To provide justification for ST and SSW in seeking funding through the AMP process for the required infrastructure; and

- Highlight the need for a strategic approach to surface water management e.g. continued development of SWMPs across whole areas rather than from individual developments.

12.2 Developer Checklist

The overall intention is that all developers would be asked to use the Water Cycle Developer Checklist as part of the planning application process and to submit a completed version with their planning applications. The EA is a statutory consultee with regards to flood risk and the
water environment and as such, will need to sign up to the Checklist as will the Councils. The checklist provided in this Stage 1 WCS (See Appendix B) has been developed from examples used in previous WCS as well as the EA's national standard checklist available on their website. It is included in this Outline Study as a starting point to be developed further in the Detailed WCS, once it is known which development scenarios are to be taken forward.

12.3 Funding and Cost Apportionment Mechanisms

In terms of the overall funding mechanism, it is important to consider that the Government has laid down strict rules on how water companies are funded, especially with regard to domestic development, and the industry’s economic regulator (OFWAT), regulates this process. Water Companies have the responsibility for providing wastewater treatment and water supply costs to OFWAT (both of these costs in the case of ST and water only costs in the case of SSW) and they are funded through charges to customers within respective operating areas through the Periodic Review process and AMP process. In general, WCS have not considered the apportionment of developer contributions towards strategic water supply and wastewater facilities.

This Stage 1 (Outline) WCS report introduces the various policy, funding and developer requirement elements to the Black Country WCS, but it is envisaged that these will be developed further in any detailed Stage 2 (Detailed) WCS, should such a study be necessary.

The Stage 1 WCS has highlighted that there is a need for expenditure on new infrastructure in the following areas:

- Wastewater treatment and sewerage,
- Large scale surface water management schemes,
- Smaller, site specific surface water management.

Although the options for providing the additional infrastructure will be developed further in any future Detailed Study, it is important to consider funding at a strategic level now to inform the development of the Detailed WCS.

In summary, developers can be included into the financial contribution in two ways:

**Stage 1 & 2 - Stakeholder Participation**

Sometimes other WCSs have invited property developers to the stakeholder group to provide an input into the direction of the study. It is important to ensure that all developers involved are represented so as to avoid giving any unfair advantage to any one group of developers. In so doing, the developers who are involved would be best placed to undertake the recommendations from Stage 2 of the WCS and ensure that these are incorporated into the design of the developments.

**Stage 3 – Infrastructure Funding**

Developers may also contribute to the capital works of infrastructure required within the WCS, although in general this would not apply to wastewater or water supply infrastructure as this is
regulated by the Water Companies through OFWAT. It should however be noted that developers can contribute to strategic wastewater mains, which are required to serve a specific development. It could also include contributions for funding large scale flood risk mitigation measures, with particular emphasis on large scale surface water attenuation storage scheme for development in and around the Black Country.

12.3.1 Minimisation of Cost

Despite this, developers can at least contribute to minimising the capital cost of water infrastructure. It can be seen from the assessment of future demands (see Table 4.3 in section 4.5.2.1) existing infrastructure that a key variable is water consumption per capita. To a large extent developers are being encouraged to do this through initiatives such as the Code for Sustainable Homes and the amendments to the Building Regulations. Both of these now strongly promote technologies such as grey water recycling, designing developments with less impermeable surfaces, specifying higher quality materials for pipework etc.

Other examples include:

- If the percentage return to sewer can be reduced from 90% to 75%, the number of additional properties that can be accommodated per 1 m$^3$d$^{-1}$ headroom at an existing WwTW is 0.8; and

- Higher quality pipes could reduce the infiltration of groundwater into drains thereby increasing the number of houses that could potentially be served by a given WwTW.

12.3.2 Water Resource Provision – Manufacturing Sector

From December 2005, non-household customers who are likely to be supplied with at least 50 million litres of water per year at their premises are now able to benefit from a new Water Supply Licensing mechanism. If eligible, they may be able to choose their water supplier from a range of new companies entering the market. The Water Supply Licensing mechanism enables new companies to supply water, once OFWAT has granted them a licence. These companies can compete in two ways:

- By developing their own water source and using the supply networks of appointed water companies (such as ST and SSW) to supply water to customers’ premises. This would be carried out under the combined water supply licence; and

- By buying water ‘wholesale’ from appointed water companies (such as ST and SSW) and selling it on to customers. This is done under a retail water supply licence.

These are potential options for the manufacturing sector to be provided with these services in the Black Country.

12.3.3 Cost Apportionment Mechanism

The Stage 1 WCS has considered that surface water attenuation will be required in order for new development to comply with PPS25. Developers could contribute towards the cost for provision
of this on a strategic level. In addition, there are potential options for developer contribution towards strategic sewerage infrastructure provision. Dependent on the options taken forward in the detailed study, a potential charge could be made to developers through the Section 106 mechanism with the various Black Country Councils setting up a fund to receive Developers’ contributions and to use them to fund works.

Research for the Corby WCS has identified that there is a legal requirement for such contributions to be made on the basis of commensurate impact of each development, for instance according to its location in the catchment. This mechanism has already been applied successfully in Corby, whereby contributions have been agreed via Section 106 agreements for two key developments; this is an important precedent.
13 Conclusions and Recommendations

13.1 Overview

The Black Country Outline WCS has identified the existing capacity of the current water environment and water cycle infrastructure and has used this assessment to determine where additional investment is required to supply new infrastructure or protect the water environment. The conclusions of each assessment are presented here.

13.1.1 Wastewater Treatment and Network

- There are six WwTWs located within the study area and a further eight bordering the area. Eight of these works have been identified as potentially being impacted by proposed development within the study area and have therefore been assessed as part of the Outline WCS.

- All WwTWs (where information was available to undertake the assessment) have sizeable spare capacity to treat flows from new development in the area. However, no detailed information on trade flow was provided and therefore the assumptions that have been made as part of this assessment will need to be revisited in the Detailed WCS to refine the calculated volumetric capacity at the WwTWs.

- The existing sewer network has been used to identify the volume of proposed development that is likely to be served by each of the WwTWs and this has been used to calculate the future wastewater flows to be treated at the works and therefore future capacity.

- Based on the proposed housing development in the area, all WwTWs have the capacity to treat the new development without requiring any upgrades to the existing wastewater treatment works (in terms of volumetric capacity).

- WwTW quality consents are likely to require tightening under the WFD and as a result of the proposed growth within the area to comply with WFD standards. Some of the consents, particularly at Barnhurst WwTW is already close to BAT and therefore alternative treatment options may be needed to treat the additional effluent generated from the proposed development in the study area. A Monte Carlo modelling exercise will need to be carried out as part of the Detailed WCS to determine the future consents required under the WFD for future effluent discharges.

- The wastewater network assessment showed that there is a good coverage of existing strategic sewers across the study area which will facilitate new connections to the existing network. However, detailed modelling will need to be undertaken to assess the capacity in the network especially in areas where more than one regeneration corridor will feed into the same sewer i.e. Ray Hill and Roundhill catchments, or the area does not currently have an existing strategic network but significant growth is planned, i.e. Brierley Hill.
13.1.2 Water Resources and Supply

- The proportion of water supplies for the Black Country coming from surface water and groundwater sources is roughly 60:40.

- In general, the CAMS document for the area show the River Severn to either have ‘No Water Available’ or ‘Over-abstracted’ (in the Rivers Stour, Worfe and Salwarpe, and associated groundwater bodies).

- The EA assessed the Black Country as lying within an area of moderate water stress.

- The Black Country is served by two water companies, ST and SSW. The parts of the Black Country lying within ST’s Severn WRZ (3) are the areas around Wolverhampton and also southwest corner of the Black Country around Stourbridge and Halesowen. SSW provides water only services for the four population centres of Dudley, Sandwell and Walsall.

- ST’s draft WRMP indicates a supply/demand shortfall within the Severn WRZ (3) over the entire planning period through to 2035. Their final WRMP to be published shortly (subject to DEFRA’s approval) indicates a worsening position in terms of deficits once the latest effects of Climate Change are included. As a result, ST is now proposing resources schemes (mainly groundwater) and demand management measures within WRZ 3.

- In the case of SSW, their position is one of having sufficient resources to meet the forecast growth in demand plus target headroom for both the annual average and peak week conditions throughout the plan period to 2035. Demand management measures are therefore all that is required by SSW.

- ST and SSW have both assumed the growth contained within the WMRSS, JCS growth figures are slightly above those contained with the RSS.

- Under the proposed JCS and based on Water Company consumption figures (Scenario 1), the total residential water demand for the Black Country up to 2026 would be 18 Ml/d. Broken down into the individual population centres, then the demands are highest in Sandwell (6.3 Mld\textsuperscript{-1}) and lowest in Walsall (3.3 Mld\textsuperscript{-1}), although Wolverhampton (3.7 Mld\textsuperscript{-1}) is broadly similar.

- An estimate for the total non-residential demand for the Black Country up to 2026 would be 10.8 Mld\textsuperscript{-1} (Scenario 1, Water Company forecast). The largest growth in the non-residential demand would come from the Sandwell area (4.18 Mld\textsuperscript{-1}), whilst the growth the other three population centres is between 2.1 to 2.3 Mld\textsuperscript{-1}.

- Both ST and SSW recognise the importance of water efficiency in managing the future growth in demand within the Black Country. Leakage control will continue to play an important part, although it has to be recognised that maintaining leakage at existing levels with an increasing network will require a significant commitment from both water companies.

- Scott Wilson’s initial assessment of the potential benefits from adopting a Water Neutrality position on all future residential development within the Black Country would indicate that it is a realistically achievable target for the Black Country Authorities to aim for in its WCS. In order to achieve this would require the 332,000 currently unmetered households to reduce
their water consumption to rates equivalent to just above the level required in order for dwellings to meet the CSH Standard Level 1/2 (i.e. around 120 l/h \( \cdot \) d \( \cdot \) -1).

- There are currently over thirty Source Protection Zones within the Black Country area. The presence of a Major Aquifer, the Sherwood Sandstone Aquifer of the Staffordshire Basin, will be an important consideration when selecting which types of SUDS techniques are most appropriate for different development areas.

- Other potential risks to water supplies within the Black Country include; Review of Consent process, Climate Change, groundwater quality/WFD issues and water supply resilience issues.

13.1.3 Water Environment

- Water quality within the Black Country has been assessed downstream of eight WwTWs as these watercourses are most likely to be impacted by proposed growth within the study area. The water quality was assessed against current water quality objectives and future WFD targets.

- In general, water quality within the Black Country area is of poor quality, but has complied with current objectives over the latest Environment Agency reporting periods.

- Four of the eight watercourses are candidate Heavily Modified Water Bodies and one is candidate Artificial and are therefore required to reached ‘good ecological potential’ by 2015.

- None of the watercourses are currently achieving ‘good ecological status’ or ‘good ecological potential’ under the WFD, with biological and Orthophosphate frequently being assessed as poor or bad.

- A detailed water quality assessment will need to be undertaken as part of the Detailed WCS to assess the impacts of proposed growth on downstream water quality.

- Water Cycle Studies should be compliant with the requirements of the Conservation (Natural Habitats &c) Regulations 1994 (as amended 2007), which interprets the EU Habitats Directive into English & Welsh law. Development may lead to impacts on the Humber SAC and Severn Estuary SPA & RAMSAR site and this should be considered further, in consultation with other stakeholders, during any Detailed WCS.

13.1.4 Flood Risk and Surface Water Management

- A Scoping Level SWMP was conducted as part of this WCS for the Black Country. High-level flood risk issues were included in this assessment.

- The heavily urbanised nature of the Black Country and its corresponding high level of impermeable surfaces, the extensive network of culverted rivers, and steep sided valleys, result in a high susceptibility to localised surface water flooding during periods of intense rainfall.

- As emphasised in the register of historical flood incidents (Table 6-3), there are many potential causes for surface water flooding in the Black Country. Furthermore, these flood sources are often interlinked, thus exacerbating surface water runoff. A simple analysis of...
past flood events using the SPR method is therefore not possible in most cases given the limited data collected by the Councils and the EA during a particular incident.

- During heavy rainfall events, overland flow and surface water runoff is caused by natural topographic gradients, but can also be generated by, or combine with:
  - Highway drainage or sewer design capacity exceedance or unsuitable maintenance regime;
  - Culvert blockage;
  - High levels in the receiving watercourse preventing discharge from the drainage system;
  - Fly-tipping;
  - Canal bank failure / overtopping / maintenance works.

**Dudley MBC**

Dudley MBC includes the towns and urban areas of Dudley itself, Stourbridge, Halesowen, Kingswinford, Brierley Hill and Sedgley / Coseley. The borough lies on the Severn side of the Severn-Trent catchment. The River Stour runs from east to west through the southern end of the borough and its tributaries drain most of the borough (as well as parts of Sandwell and Wolverhampton), before joining the River Severn at Stourport. Only Coseley in the northeast corner of the borough drains to the Tame catchment. Generally, Dudley MBC is located on higher grounds, hence fluvial flooding is not a significant issue.

**Sandwell MBC**

Sandwell MBC is almost entirely urban. It is centred on West Bromwich and includes the towns of Wednesbury, Tipton and Oldbury. The borough lies on the east side of the River Severn catchment and is also drained northwards by the headwaters of the River Tame, which then flows from west to east along the border between Sandwell and Walsall. The borough lies at the upstream end of both River Severn and River Tame catchments. Fluvial flooding is therefore not critical in this area (reportedly, an assessment on the summer 2007 floods is available at the Council but could not be consulted for the purpose of this study).

**Walsall MBC**

Walsall MBC includes the urban areas of Walsall, Brownhills, Aldridge, Bloxwich, Willenhall and Darlaston. The south, west and centre of the borough are heavily urbanised but there are a number of isolated rural pockets in the north and east. The borough almost entirely drains southwards towards the River Tame.

**Wolverhampton CC**

The City of Wolverhampton occupies much of the borough (with the town of Bilston in the south west corner) and is heavily urbanised. It lies on the western side of the Birmingham plateau some 122 metres above sea level. Most of the borough lies in the headwaters of the Stour and Tame catchments (western and eastern parts, respectively), whilst the northern edge of the borough drains into the River Penk.
Wolverhampton was not significantly affected by floods during summer 2007, for reasons linked with its historical drainage infrastructure development, its natural contours and its location upstream of the country's primary river basins\(^58\). Although June-July 2007 was very wet (approximately 312 mm, or 267% of 1961-1990 average\(^59\)), the most intense event on 20\(^{th}\) July tracked down to the south and west of the Black Country, leaving the Black Country relatively unaffected.

Dudley, Sandwell and Wolverhampton receive very little drainage from adjacent boroughs, being located at the upper end of their catchments. Therefore these Councils need to be aware of the downstream impact that development will place on the river and drainage systems, as well as the corresponding downstream communities. This has been achieved, for instance in Wolverhampton, by providing underground storage tanks in strategic locations or artificial storage reservoirs (e.g. the one at the centre of the racecourse).

**Flooding in the Black Country.**

Data analyses and site visits out have highlighted the localised, scattered and interlinked nature of flood incidents associated with surface water runoff across the Black Country. It is therefore difficult at this stage to recommend specific areas where investments in significant drainage schemes may be required or best utilised.

Incidents are often due to culvert blockage or drainage capacity exceedance, future investment should rather focus on the following.

- **Enhanced trash screens and gullies maintenance (short-term):** In most parts of the Black Country, maintenance works are undertaken following a risk-based methodology, drawing upon local knowledge. This approach should be formalised and enhanced through the permanent collection of additional information (e.g. residents complaints register, systematic reporting of blocked gullies during clearing works).

- **Creating opportunities through re-development to alleviate Surface Water Flood Risk (short to medium-term):** This could be achieved through close coordination between Developers and the Councils' Drainage Engineers in the shaping of the overall drainage layout (impact of development proposal on maintenance regimes, suitability of proposed drainage techniques, etc.). This would ensure that Local Planning Policies (SPDs and DPDs) regarding surface water runoff management, use of SUDS and the opening up of culverted watercourses are fully considered.

- **Improving asset management and ensuring knowledge transfer through the development of a drainage assets database for the four Boroughs (medium-term):** There are potentially significant amounts of local knowledge at the Councils that may be lost if not archived, shared and updated.

- **Managing flood risk better and improving the environment by naturalising the river system (medium to long-term):** Opportunities to undertake de-culverting of watercourses should be sought as development proposals come forward. Consideration should be given at this stage to the use of Section 106 agreements.

\(^{58}\) Wolverhampton City Council, Flood Risk Management - The Pitt Review - Open Executive Decision Item, 30\(^{th}\) September 2008.

• **Undertaking an Outline SWMP (short-term):** Now that the preparation stage is completed, we recommend the commencement of the Risk Assessment stage (Outline SWMP, Stage 2). This is based on level of existing surface water flood risk, the degree of interaction between flood sources and pathways and the proposed level of new development. An identification and selection of areas prone to surface water flood risk, based on detailed topography (LiDAR data) should be carried out using numerical modelling techniques. Please refer to Section 6.8 for more detailed information on modelling requirements for the Black Country.

13.2 Scenario Recommendations

• The timing of the AMP5 Business Planning process has unfortunately meant that the level of engagement from ST and SSW has not been sufficiently detailed enough to enable completion of this aspect of the full Outline Study.

• Rather than speculate on what ST and SSW might find acceptable in terms of future development scenarios, this aspect of the study should be deferred until detailed Stage 2 WCS.

13.3 Scope for Stage 2 Black Country WCS

• To incorporate the findings from both ST and SSW final WRMPs.

• To hold workshops with ST to discuss both water supply and wastewater issues identified above and if possible, to run models to quantify the amount of spare capacity in the existing networks.

• To understand how variations in both occupancy rates and peaks in demands may put added on pressure on the water supply system.

• To investigate further the issue of ‘water neutrality’, including an estimate of the costs of achieving this.

• To investigate the spare capacity available at each WwTW, taking into account treatment process restrictions.

• To address any hydraulic issues of the receiving watercourses from increasing the discharges from WwTWs.

• To consider the phasing of future development areas within the Black Country.

• To consider the possible funding mechanisms available for making contributions to strategic infrastructure.
14 Progression of the WCS and SWMP

14.1 Introduction

Following the presentation of the final draft report (Black Country Outline Water Cycle Study and Scoping Level Surface Water Management Plan) on 4 August 2009 to Dudley, Walsall and Sandwell Councils, it was requested that the next steps in terms of Detailed WCS and Outline SWMP be listed summarised for programming and discussion purposes.

The lists below are intended to be used as an interim guide to help inform future planning and investment decisions. A more detailed scope of services would need to be produced (by the Black Country Authorities) in order to provide definitive costs.

Figure 14-1 summarises the relationship between the WCS, SWMP and SFRAs at more detailed levels.

**Figure 14-1: Relationship between WCSs and SWMPs at all Levels of Detail**
14.2 Issues for Consideration in Detailed WCS

- Detailed analysis of wastewater network (WwTWs and sewer network) in conjunction with ST, including modelling where appropriate,
- Assessment of impacts of trade flow,
- Detailed review of discharge consents,
- Detailed consideration of process issues at Barnhurst WwTW in conjunction with Severn Trent,
- Process capacity assessment, including Monte Carlo modelling,
- Analysis of DG5 data from Severn Trent,
- Impacts of capacity of receiving watercourses,
- Clarification on impacts of water supply from Wales and Herefordshire,
- Detailed assessment of impacts of growth on river standards (including water quality and environment),
- Impacts of development on Humber SAC and Severn Estuary SPA and RAMSAR,
- Options and funding for required new infrastructure (including upgrades),
- Enhancement of developer checklist,

14.3 Issues for Consideration in Outline SWMP(s)

- Develop stakeholder engagement and communication strategy,
- Undertake pluvial modelling of the Black Country growth areas and prepare Outline SWMP targeted at growth areas only,
- Detailed SuDS appraisal, decision tree and customised guidance for Black Country developers.
- Detailed assessment of groundwater flooding,
- Establish drainage asset register (per Government requirements),
- Formalise inclusion of British Waterways into Black Country Stakeholder Group for next phase of study and agree terms of reference,
- Development of an Outline River Corridor Improvement Plan,
• Development of guidelines for SuDS maintenance regimes,
• Development of site wide strategic drainage plans,
• Detailed requirements for SuDS (once layouts have been determined),
• Analysis of piezometric maps and borehole groundwater levels,
• Production of maps of areas with shallow groundwater tables, which are typically not suitable for SuDS,
• Production of maps identifying areas of favourable infiltration drainage.
15 References


