

River Tame Flood Risk Management Strategy

**Environmental Report
May 2009**

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Chapter 5 - Key Issues, Constraints and Opportunities

**Chapter 6 - Assessment of Environmental Effects and
Evaluation of Impact Significance (part 1 of 2)**

5 Key Issues, Constraints and Opportunities

This section records the baseline environmental data collected and the key strategic issues identified for the topics or environmental receptors considered relevant at the strategic level. The factors that we did not consider relevant at the strategic level (determined during the scoping phase – see Section 2.2) are not included here.

In this section we provide baseline information about all of the topics that we identified during the scoping phase as having the potential to be affected by the flood risk management Strategy options. We describe the current status of each topic (e.g. the current population distribution, or the current locations and status of nature conservation sites). Where possible we also describe any important trends that will allow us to predict how the status of each environmental receptor may change in the future, over the lifetime of the Strategy.

5.1 Human

A total of 1.7 million people live within the catchment. The main centre of population in the catchment is the conurbation comprising Birmingham, Solihull and the Black Country. Birmingham and its surrounding urban area is a key driver of the West Midlands' economy and acts as a focus for jobs, commercial interests, services and facilities, as well as providing large residential areas.

Other large towns include Hinkley and Nuneaton, in the upper part of the Anker catchment, and the town of Tamworth, on the lower Tame (see Figure 2).

There has been a net migration of people and investment away from the areas of Birmingham and Solihull, and the Black Country over recent years. However, these areas, and the town of Tamworth are designated as Major Urban Areas within the Regional Spatial Strategy³ and will act as a focus for urban regeneration and renewal into the future. They are therefore likely to remain the areas of greatest population density within the catchment.

³ Regional Spatial Strategy for the West Midlands (2008)

A total of 2460 residential properties are at risk from flooding from the River Tame, for a flood event with a 1 % probability of occurring, with the current defences in place. This figure would rise to 8035 properties, if all defences were removed or all failed. These properties are mainly concentrated in a few critical areas, particularly around Brookvale Road (Witton), Bromford, Fazeley and Tamworth. Table 5 outlines the numbers of properties in each reach that are currently in the floodplain and the number of properties that are currently at risk in the floodplain.

Table 5: Number of residential properties at risk during a flood event with a 1 % probability of occurring in any year

Reach	Reach Description	Number of properties currently in floodplain*	Number of properties currently at risk in the floodplain**
1	Oldbury Arm	937	221
2	Willenhall Arm	224	0
3	Circa Bescot Junction	0	0
4	Circa Newton and Hamstead	148	0
5	Circa Perry Barr and Brookvale Road	621	546
6	Gravelly Hill	3124	1200
7	Water Orton and Lea Marston	280	241
8	Fazeley and Tamworth	2483	233
9	Downstream of Tamworth	218	18
Total		8035	2459

* Includes all properties at risk within the flood envelope of a flood event with a 1 in 100 (1%) chance of occurring in any year with all defences removed from the catchment.

** Includes all currently undefended properties within the flood envelope of an event with a 1 in 100 (1%) chance of occurring in any year assuming all the defences are operational

The potential impacts of flooding on the population within these areas at risk from flooding include direct damage to property, disruption to day-to-day life and risk of injury or loss of life during a flood event. The impacts of flooding can also extend to post-flood difficulties such as problems with insurers and builders. Flooding and fear of flooding has also been demonstrated to cause adverse health impacts to people in flood risk areas, particularly psychological (Ramsbottom *et al*, 2003).

Human: Key Strategic Issues

- Population and properties at risk from flooding concentrated in urban areas of Birmingham and Tamworth.
- Safety, security and social well being of people living within the floodplain.
- Opportunities to encourage and contribute to improving the character of urban settlements.

5.2 Landscape

The majority of the River Tame corridor lies within the West Midlands conurbation, with a significant stretch of the river running through the western edge of Tamworth, resulting in over 40% being within urban boundaries. Whilst these areas are predominantly dense and industrial, with tracts of derelict land and significant areas of 19th and 20th century housing, pockets of open and amenity space do exist. Through these urban areas, the river is confined and restricted and only opens up through the open spaces. The remaining 60% falls within the rural landscape. These areas are somewhat fragmented comprising mixtures of agricultural land, urban developments and industrial landscapes associated with the extractive industry. The upstream reaches are predominantly urban and the downstream are rural.

Green Belt designation does afford the rural landscape surrounding Birmingham some protection, and separates the urban areas of Tamworth and the West Midlands conurbation.

5.2.1 Joint Character Areas

Joint Character Areas (JCAs) are subdivisions of England into areas of similar landscape character. The River Tame catchment flows through the following JCAs (see Figure 3):

- Cannock Chase and Cank Wood;
- Arden; and
- The Trent Valley Washlands.

Cannock Chase and Cank Wood: The upstream Oldbury and Wilenhall Arms of the River Tame fall within this area. The majority of the urban areas through which the River Tame flows are dense and industrial, with areas of abandoned, derelict or reclaimed land.

Pockets of amenity space and public open space do exist, the most significant of which is Sandwell Valley. The canal network also form a significant landscape feature.

The central reaches of the river, which flow through the area of Birmingham, lie within the **Arden** character area. Birmingham has a clearly-defined concentric pattern of development. Much of the landscape is dominated by 19th and 20th century housing, the former in characteristic red brick. Canals, parks, golf courses and the river corridor form the main open spaces, with a substantial parkland area around the University at Edgbaston and some low-density garden suburbs like Bourneville. Enclosed within the urban area are fragments of older landscapes like Castle Bromwich Park.

The downstream stretch of the River Tame falls within the **Trent Valley Washlands** character area. The Tame and its floodplain form a distinctive narrow strip of flat valley land. The Washlands comprise a somewhat fragmented landscape of pastoral and arable land intermixed with urban development. The sands and gravels of the river terraces have been extensively exploited resulting in a disrupted landscape of active pits, industrial plant and water-filled disused pits. This evolving landscape is particularly noticeable in the valley of the Tame, where recently restored gravel pits form a network of water-bodies used for water sports, or maintained for conservation or informal recreation purposes (e.g. Kingsbury Water Park).

5.2.2 *Local landscape character assessment*

A macro scale strategic landscape assessment was carried out for the rivers Blythe, Cole and Tame in 1993⁴. This study assessed the landscape resource along the river corridors and developed a strategy for its management. Three management actions were developed:

- **Conservation:** emphasis on conservation of existing character and on appropriate management of particular features which contribute to this character;
- **Restoration:** emphasis on restoring landscape character where this is being degraded; or
- **Enhancement:** emphasis on the enhancement of landscapes which have completely lost their former character and are downgraded, derelict or otherwise damaged. There may be opportunities to create new types of landscape as a result of enhancement.

⁴ Ashmead Price, on behalf of National Rivers Authority, Severn Trent Region (February, 1993).

The areas with the most valuable landscape resource are in the upper Blythe catchment, particularly around Hampton in Arden and Coleshill.

The majority of the river Cole (upstream of the M6) and of the upper Tame (upstream of Lea Marston) were assessed as degraded landscape character, due to factors such as modification of the river channel and development of industrial and urban elements adjacent to the river. These areas would benefit from enhancement or creation of new landscapes.

The lower Cole catchment, between the M6 and the River Tame has some areas where landscape degradation has occurred, which would benefit from restoration.

The lower Tame catchment, between Lea Marston and the confluence with the Trent contains some areas of valuable, un-degraded landscape character which need to be conserved, particularly for a few kilometres downstream of Lady Bridge at Tamworth. The remaining areas of the lower Tame have some degraded landscape elements and would benefit from restoration.

5.2.3 *The National Forest*

A very short stretch of the River Tame (approximately 2 kilometers, immediately upstream of the confluence with the River Trent) falls within the National Forest. The National Forest initiative aims to achieve large scale landscape change by blending new and maturing woodland within a wide variety of landscapes.

5.2.4 *Landscape Resource*

Through the main urban areas and on the urban fringe there are several important open spaces, providing pockets of landscape resource along the length of the river corridor.

Those of particular significance include the following:

- Sandwell Valley Country Park: 809 hectares of parkland comprising woods, marsh and open fields with several ponds. It is formed from the Tame Valley and supports a variety of habitats (see also Section 5.6.1).
- Castle Bromwich Hall Gardens: 10 acre English baroque gardens, located to the south of the River Tame in the east of Birmingham. These have been restored to the 1680-1740 period from which they originated.

- Kingsbury Country/Water Park: this recreational resource also provides a distinctive landscape feature as a result of the cluster of lakes and waterbodies.

LANDSCAPE KEY ISSUES

- Public open space/landscape is scarce within the large urban conurbations particularly in the upper Tame and upper Cole river corridors. It is therefore critical to ensure that where these pockets of open landscape exist, they are protected and where possible, enhanced.
- In the lower Tame, there is a need to preserve valuable landscape character and restore areas where landscape character is being degraded.
- In the upper Tame, there are areas of degraded landscape character, resulting from factors including modification of the river channel and development of industrial and urban elements adjacent to the river. These areas would benefit from enhancement or creation of new landscapes.
- Opportunities to encourage and contribute to urban regeneration by developing opportunities which focus on opening up and improving the landscape quality of the river corridor.

5.3 Land Use and Soils

The range of land uses now present across the Tame catchment stem from the combination of the natural resources available, their historical exploitation, and the subsequent urbanisation that has taken place. Land use in the upper Tame catchment and in the river Rea and upper river Cole catchments is predominantly urban. The predominant land use in the lower Tame catchment as well as the catchments of the Blythe and the Anker is agricultural land, although some large urban areas exist (e.g. Tamworth, Solihull, Nuneaton and Hinkley).

5.3.1 Industry

The Tame catchment has a history of industrial usage. In the 19th century large quantities of mineral resources in the Black Country enabled the development of heavy industries such as steel, iron, brick and glasswork. These in turn enabled the establishment of final assemblers, often based in Birmingham and Solihull. The Black

Country began to decline in prosperity after 1860 due to the natural mineral resources being exhausted and light engineering with new technology gradually replaced heavier industries. Since the early 1980s, an increasing number of these redundant brownfield sites have been redeveloped.

The large areas of impermeable surfaces, particularly in the upper Tame catchment as it flows through the urban area of Birmingham, cause rivers and streams to rise quickly in response to rainfall. This means flows are extremely variable and pulses of pollution may occur. This historic industrial land use has placed continued pressure on the river corridor, resulting in heavy contamination and straightening / modification of the river channel to prevent flooding. These factors have led to a major reduction of natural habitat and bankside features. However, redevelopment provides the opportunity to remediate sites and ensure the water environment is enhanced by redevelopment.

5.3.2 *Mineral Extraction*

The Tame catchment has been extensively mined and quarried for its mineral resources including limestone, coal, ironstone, clay, brick-clay, sandstone, sand and gravel. Most of this activity has now ceased and the area is a net importer of its mineral requirements.

Mineral extraction has historically played a major part in determining the development of the Tame catchment. Coal mining was a major activity in the catchment and a legacy of pollution remains with problems of spoil heap run-off and acidic discharges into the river, particularly at times of flood.

Downstream of Lea Marston there are large sand and gravel workings in the Tame Valley. Much of the site restoration has involved creation of open water providing major recreational and conservation opportunities such as at Kingsbury Water Park and Middleton Lakes.

5.3.3 *Agriculture*

There is a mixture of livestock and arable farming across the catchment. Agricultural land quality (see Figure 4) is predominantly Grade 3 (good – moderate), though significant pockets of higher grade land are spread throughout the catchment. The land within the floodplain of the River Blythe, lower river Anker and lower River Tame is classified as Grade 4 (poor), likely to be a result of its regular inundation.

Over the last 10-15 years the area of land in agricultural production has generally declined. This is due to changes of land use e.g. through development of new housing, roads, golf courses, or to other uses such as grazing for horses. In addition, intensification of food production has resulted in larger fields, more efficient drainage systems and heavier machinery causing deeper compaction of soils. These factors combined with changes in cropping practice have the potential to decrease infiltration and hence increase flood risk.

Government initiated programmes such as the Environmental Stewardship Scheme (ESS) provide funding to farmers and other land managers who deliver effective environmental management on their land. Its primary objectives are to conserve wildlife, maintain and enhance landscape character and quality, protect the historic environment, promote public access and understanding of the countryside. A secondary objective is flood risk management.

Large areas of agricultural land within the Anker, Blythe and lower Tame catchments are managed under the entry level ESS. However, land managed under the ESS scheme in the vicinity of the River Tame is confined to parcels of land immediately upstream and downstream of Middleton Hall and a number of pockets of land between Tamworth and the Trent confluence (see Figure 4).

LAND USE KEY ISSUES

- Extensive historical industrial land-uses have left a legacy of contamination, particularly in the upper Tame. This may limit the creation of new flood storage areas.
- Gravel extraction has left a legacy of large ponds adjacent to the Tame. There is an opportunity to seek flood storage by tying in with gravel extraction reclamation plans.
- Agricultural land dominates the lower catchment. Changes to farming practices and land uses have resulted in faster flows of surface water run-off.

5.4 Critical Infrastructure

Critical infrastructure which is vulnerable to flood risk or vital for delivering an effective response to flooding includes utilities (water, energy and telecommunications), and the national strategic road and rail network.

Significant parts of the national motorway network run through the study area. In many places the River Tame flows adjacent to or beneath the M6, M42 and M6 Toll Road. There are also important primary routes, and A roads within the vicinity of the river.

The strategic rail networks also run through the catchment. Birmingham New Street Station forms an important intersection of rail lines to the northwest, northeast, southwest and London and the southeast.

There are also a number of important utility infrastructure sites located within the river corridor. Many of these utility sites serve large populations within the Birmingham conurbation and therefore are of high importance.

Figures 5a-i show the locations of critical infrastructure within the vicinity of the River Tame and those within the existing 1 in 100 year flood outline.

CRITICAL INFRASTRUCTURE KEY ISSUES

- Key railway track and primary road routes within the 1 in 100 year flood outline.
- Three sewage treatment works and 70 power stations/ substations within the 1 in 100 year flood outline.
- Potential for significant disruption to transport networks, loss of power and water quality / public health issues due to damage to this infrastructure during severe flood event.

5.5 Water

5.5.1 Water Quality

The effects of urbanisation and industrialisation on the Tame were such that, in 1945 the river was devoid of life. The situation has greatly improved in recent years due to the decline of industry, improvements in sewage treatment processes and the tightening of legislation relating to pollution and water quality.

The most recent water chemistry monitoring results are summarised in

Table 6 below. These show that the lowest water quality is found in the upper, urban reaches of the river. However downstream of the Coleshill STW the water quality is classified as 'Fairly Good' to 'Good'. In all stretches of the River Tame, the water quality complies with its river quality objective. The water quality of the River Tame has generally shown an improvement over the period 1990 – 2006, and it is only in recent years that all stretches of the river have achieved compliance with the water quality objectives.

Table 6: Summary of recent river quality chemistry results

River Stretch	Chemistry Grade (2006)	Complies with river quality objective?
Tame (Willenhall Arm)	E	Yes
Tame (Oldbury Arm)	C-D	Yes
Tame (Confluence of Oldbury and Willenhall Arms to river Rea)	E	Yes
Tame (river Rea to Coleshill STW)	D	Yes
Tame (Coleshill STW to river Anker)	C-D	Yes
Tame (Anker – Trent)	C	Yes
River Rea	B-D	Yes
River Cole	D-F	No (18km stretch)
River Blythe	B-C	Yes
River Anker	B-C	Yes

The Water Framework Directive (WFD) will drive improvements in water quality into the future. The country has been split into a set of river basin districts and a River Basin Management Plans (RBMP) for each river basin district will be produced by December 2009 and reviewed on a six yearly cycle. The overall aim of the WFD is to restore waters to good environmental condition, or good environmental potential (in the case of heavily modified water bodies) by 2015. Achieving good environmental condition requires both good chemical status and good ecological status, and takes into account factors such as water flow and physical habitat, as well as water chemistry.

As part of the river basin planning process, the significant water management issues have been identified for each river basin district. These are issues that are likely to lead to failure of objectives if not addressed.

The significant issues that are affecting water quality of relevance to the Tame catchment include:

- Diffuse pollution from urban areas and transport (e.g. highway runoff);

- Diffuse pollution from rural areas.

Draft WFD objectives for the River Tame have been developed and were published in December 2008. The river within our study area has been divided into five reaches and objectives produced for each reach. They are summarised in

Table 4 (p35).

Diffuse pollution from urban areas is a significant issue in the upper catchment. During dry periods there is a build up of oil, rubber, particulates and other materials on roads and paved areas, which is washed into watercourses following rainfall. This contamination can have significant impacts on water quality, in particular a reduction of dissolved oxygen levels, which can lead to the death of fish and other aquatic life due to pollution flushes in times of flood.

The River Tame passes through a series of lakes at Lea Marston, which are designed to settle out contaminated sediment. This material is prevented from entering the lower Tame and eventually the River Trent. The construction of Lea Marston purification lakes has led to improved downstream water quality and to the achievement of viable fish populations in the main river.

5.5.2 *Geomorphology*

The River Tame has been subjected to heavy modification over the years. In many sections the river flows through culverts and a large section of the river channel was realigned during the construction of the M6, M42 and M5 motorways and the strategic rail links. Within the upper reaches, little of the natural floodplain or natural channel remains along the river.

The lower Tame, downstream of the confluence with the River Blythe, exhibits a more natural geomorphology. The river has good connectivity with its floodplain over large stretches, although a legacy of gravel extraction within the floodplain has disrupted the natural geomorphology in places.

There have been a number of river restoration projects carried out on the River Tame from Kingsbury to Tamworth. The largest is at Middleton Hall where 1.3 kilometer of river was restored as part of a gravel extraction restoration scheme. In addition the Environment Agency has carried out a series of small scale projects on the Tame within Kingsbury Water Park. Further restorations are planned at Kingsbury and Tamworth. All these, combined with the natural mobility of the river, have resulted in the Tame downstream of Lea Marston showing the greatest physical recovery of any river in the upper Trent catchment.

The extensive physical modification of the river in the upper Tame catchment is an important issue for the River Tame. As well as being a factor which influences the environmental condition of the river, it also influences the river's response to high rainfalls, and hence is of importance in flood risk management.

WATER QUALITY KEY ISSUES

- All stretches of the river currently meet their strategic chemical water quality targets.
- Diffuse pollution (urban and rural) is a significant issue affecting water quality in the catchment.
- Heavy modification of the river (e.g. through canalisation and culverting) is a significant issue affecting the ecological potential of the River Tame.
- Requirements of the Water Framework Directive will have a significant impact on the management of water quality issues of the River Tame in the future.

5.6 Biodiversity, Flora and Fauna

5.6.1 Designated Sites

Figure 6 shows the locations of sites designated for their nature conservation interest within the catchment. Many of the sites are classified as being of local importance only and impacts on the majority of these local sites will be considered further at more detailed level of environmental assessment. Some nationally important sites are present (e.g. Sites of Special Scientific Interest (SSSI) and National Nature Reserves (NNR)).

The sites which have the potential to be affected by flooding, or measures used to manage flood risk include:

- **River Blythe SSSI:** the 3 kilometer designated stretch upstream of its confluence with the River Tame is a fine example of a lowland river on clay. It has a wide range of natural structural features combined with a high diversity of substrate types. Botanically, the Blythe is one of the richest rivers in lowland England and the river also supports a diverse invertebrate community. Several damp, unimproved meadows occur along the length of the river, which receive some of their water from annual flooding and are largely dependent upon the river for the maintenance of a high water-table. The latest condition survey (February 2006) assesses the condition of the river as 'Unfavourable: No Change'. The factors contributing to the unfavourable condition include poor water quality, and invasive species.
- **Alvecote Pools SSSI:** a series of shallow pools which have arisen as a result of colliery subsidence. They lie along the course of the River Anker. The site is one of the most extensive and diverse wetland areas in the county and supports a regionally important bird community. The latest condition surveys (2003-2006) assess 35% of the site as being in favourable condition, and 65% of the site as

being in unfavourable: declining condition. The factors contributing to the unfavourable condition include poor water quality resulting from discharges from upstream sewage treatment works.

- **Birches Barn Meadows SSSI:** comprises two unimproved fields adjacent to the south bank of the river Anker. They have been managed as hay meadows since 1913 and are now the last remaining flood meadows in the Anker valley. The latest condition survey assesses them as being in ‘unfavourable – declining’ condition.
- **Whitacre Heath SSSI:** is one of a chain of waterbodies created by gravel extraction adjacent to the River Tame. It has developed into a mixture of grassland, woodland and wetland, and is particularly important for its wetland breeding birds. The latest condition survey (February 2006) assess the condition of the site as ‘Favourable’.
- **Middleton Pool SSSI:** a well established artificial lake, that was dug and landscaped in the 16th Century and is of importance for its breeding birds. The site is located to the west of the Birmingham and Fazeley Canal, and so is unlikely to be affected by flooding or any flood risk management options. The pool forms part of **Middleton Lakes RSPB reserve** which is a former gravel quarry located between the River Tame and the Birmingham and Fazeley Canal. The site is currently being restored as a RSPB reserve on the River Tame, and although not statutorily designated, already supports regionally significant breeding wader populations.
- **Sheepwash LNR:** a former waste disposal site, which was reclaimed in the 1980s and has since been restored. The site consists of a lake which acts as a balancing area for the River Tame during flood events as well as large areas of maturing woodland, grassland pools and marshes. The site supports waders and wildfowl, a variety of small mammals and amphibians and locally rare plants.
- **Priory Woods LNR and Forge Mill Lake LNR** (both part of Sandwell Valley Country Park): Priory Woods LNR lies in the heart of Sandwell Valley Country Park. As well as woodland, the reserve contains a number of pools, a marsh area, heathland and grassland, all of which support a range of plants and animals. Forge Mill Lake supports a wide variety of wildlife, most noticeably important numbers of breeding wildfowl on the lake, including passage migrants, and a range of wild flowers. The RSPB lease and manage part of the Sandwell Valley Country Park which is managed as their Sandwell Valley nature reserve.
- **Sot’s Hole with Bluebell Wood LNR** is located approximately 750m to the northwest of Forge Mill Lake LNR. The LNR represents fragments of ancient woodland.
- **Babb’s Mill LNR and Yorks Wood LNR** are located on the river Cole, approximately 8 kilometers upstream of the River Tame. The sites comprise a stretch of the river Cole as well as adjacent habitats including ancient woodland.

- **Malvern and Brueton Park LNR** comprises 30 Hectare mixed grassland, woodland and marsh in the upper Blythe catchment.
- **Parkhall Reserve (Birm & BC Wildlife Trust):** Park Hall is an area of remnant farmland and estate grounds on the eastern edge of Birmingham. The reserve supports a diverse range of habitats, including three ancient woodlands, grassland, wetland and a stretch of the River Tame.

There is the potential that the Middleton Lakes site will be afforded statutory protection in the future, however no other additional large areas have been identified that have the potential to be designated as nationally important sites in the near future. Management plans are in place to improve the condition of SSSIs which are in unfavourable condition, and therefore it is likely that the condition of the sites will improve over time.

The Tame Valley from Chester Road to Tamworth (approximately 13 kilometers) is one of the most important large wetland areas within the West Midlands. Most of the area is within the ownership or control of conservation bodies (including RSPB, Warwickshire Wildlife Trust and the Wildlife Trust for Birmingham and the Black Country) or public bodies (including Warwickshire County Council, Tamworth Borough Council, the EA, Severn Trent Water and EoN Environmental Trust. Warwickshire Wildlife Trust, with support from all the above bodies, are co-ordinating a joint approach within the valley to maximise enhancement of wildlife.

5.6.2 *Protected Species*

There are a number of species that are protected under the Wildlife and Countryside Act (1981) present within the Tame catchment. The list of relevant protected aquatic species that could potentially be affected by the Tame Strategy includes water vole, otter, kingfisher, common toad, great crested newt, grass snake and common frog.

5.6.3 *Habitats, flora and fauna*

Three Local BAPs (Staffordshire BAP, Birmingham and Black Country BAP, and the Warwickshire Coventry and Solihull BAP) cover the study area. These set out priority habitats and species for which action plans have been developed. Those habitats of most relevance to flood risk management include: rivers and streams, lowland wet grassland, reedbeds and wet woodland. Figure 6 shows the location of reedbeds and wet woodland habitat within the catchment. The areas which are in the vicinity of the watercourse are located on the Anker, Blythe and lower Tame.

There are a number of wildlife corridors in the study area, which although not statutorily designated, provide important habitat and essential links between nature conservation sites. The Tame itself is a very important corridor both nationally as a flight path for migratory birds moving from the North East to the south west and as a local corridor

bringing wildlife into the conurbation. In the upper section of the River Tame the river corridor forms an important green corridor between Sandwell Valley and Castle Bromwich. Other such corridors include the Tame Valley Canal, Snow Hill Railway and the land bordering the M6 motorway between the River Tame and Great Barr Park.

The most relevant BAP priority species are those listed above, under protected species (section 5.6.2).

We will take all of the priority habitats and species identified in these BAPs into account as part of the SEA process, if opportunities for habitat creation arise, or if there is the potential that our flood risk management options will result in adverse effects on these habitats or species.

5.6.4 *Fisheries*

Fisheries populations are routinely monitored on the River Tame and its tributaries, but are targeted towards areas of high angling pressure. As a result there is little or no data on the upper reaches of the Tame or of the smaller tributaries.

The main current monitoring sites on the River Tame are at Tamworth, Hopwas, Comberford; Elford and the National Memorial Arboretum. These are all located in the lower Tame on the stretch from Tamworth to the Trent. Additional monitoring was undertaken further upstream in 2005, at Water Orton, Lea Marston and Middleton Hall.

The lack of data from the upstream reaches does not rule out the presence of fish and there may be stable populations in these stretches.

A total of seventeen species have been recorded in the Tame between 2005 and 2008. These include species such as Chub, Dace, Gudgeon, Perch, Pike, Roach and Stone Loach. In addition two species that are designated under the Habitats Directive have been recorded in the Tame (Bullhead and Spined Loach).

A further six species have been recorded on tributaries of the Tame, including Brook Lamprey, which is also protected under the Habitats Directive.

One species (Zander) is a non native species and was recorded in 2008 though is not recognised as having a resident population in the Tame catchment. It is likely to have spread in from the canal network via the Trent and we would seek to prevent its spread where possible.

Historically, stocking of fish has been carried out on the Tame, primarily with species such as Dace, Roach and Chub. However stocking has decreased significantly over the period since 1996 and no fish have been stocked into the River Tame since 2002. We

aim instead to create a more sustainable fishery by making sufficient habitat and water quality improvements to remove the need to stock under all but the most extreme circumstances.

The main factors which affect fisheries in the Tame catchment are:

- Modified channel structure especially in the upper Tame which limits habitat suitability for fisheries;
- Weirs / impoundment structures that restrict the free movement of some or all fish species particularly in low flow conditions; and
- Widespread populations of non native Signal Crayfish in the catchment which act as a threat to the small populations of native white clawed crayfish which are present in some of the smaller tributaries.

The following principal measures could therefore be used on the River Tame to improve fisheries:

- Re-profiling of trapezoidal channels to give shallow, sloping banks and improved habitat;
- Installation of fish passes at the impoundment structures that restrict the free movement of fish; and
- Measures to prevent the spread of non-native species (e.g. Zander and Signal Crayfish) and to protect the remaining populations of native species.

5.6.5 *Alien Species*

A number of alien species, which grow at the expense of native species, have been recorded in the Tame catchment, including Japanese knotweed, Himalayan balsam and Giant Hogweed.

Biodiversity, flora and fauna: Key Strategic Issues

- A number of nationally designated sites (SSSI) and locally designated sites for nature conservation are located adjacent to watercourses within study area. Options should seek to maintain and, where possible, enhance the interest features of these sites.
- A number of BAP species and habitats have the potential to be affected by flooding or flood risk management measures. Options should seek to protect and, where possible, enhance BAP habitats and species.
- The river and canal corridors provide important links between nature conservation sites. Options should seek to protect and, where possible, enhance the continuity of these green corridors.
- Fisheries within the catchment are limited by factors such as weirs and impoundment structures which limit the free movement of fish.
- Invasive and alien species (e.g. Japanese Knotweed, Himalayan Balsam, Signal Crayfish) are present at various locations within the catchment, and adversely affect native species.

5.7 Recreation, Amenity and Access

5.7.1 Water-based recreation

The River Tame itself provides a very limited range of water-based recreational activities.

Opportunities for angling on the upper Tame are limited by low fish populations, by a lack of suitable access points to the river and by poor water quality, particularly in the upper reaches. Between Lea Marston and the Trent confluence, both water quality and access to the river are better and fishing does take place. A number of angling clubs hold fishing rights to stretches of the Tame. Angling also takes place particularly on the rivers Blythe and Anker.

Kayaking can take place on sections of the lower Tame, as well as the Anker, Blythe, Cole, and Rea. Other water-sports take place on the canals, ponds and lakes in the area as well as at specific venues such as Kingsbury Water Park.

5.7.2 Public open space and recreational space

Public open spaces provide a valuable recreational resource, particularly within the urban areas of the river corridor. Within the urban areas of Birmingham, Solihull and the Black

Country, recreational open spaces are limited and the larger open spaces are generally found downstream of the River Blythe confluence.

Formal areas of public open space in the vicinity of the river corridor include Sandwell Valley Country Park, Sheepwash Urban Park, Perry Hall Playing Fields, Castle Bromwich Hall and Gardens, Kingsbury Water Park and the National Memorial Arboretum. In addition there are other areas of land privately owned or managed by which can be accessed by arrangement/ membership of an appropriate organisation. (e.g. Ladywalk Nature Reserve, Whitacre Heath Nature Reserve).

These areas of land are used for a range of recreational activities, including walking, cycling, playing informal sports, bird-watching and water-sports.

Public footpaths run along sections of the river, especially in the lower reaches, downstream of the Blythe. The Tame Way footpath has been proposed as a long distance route which will eventually follow the entire length of the River Tame and link up to the Trent Valley Way and other long distance footpaths.

The Tame Valley canal and the Birmingham and Fazeley canal provide green corridors which run close to the River Tame in places.

Due to the limited extent of open spaces in the catchment, green infrastructure, or the network of green spaces that intersperses and connect our cities, towns and villages, should be preserved and extended where possible to deliver benefits both for people as well as wildlife.

RECREATION KEY ISSUES

- Limited water-based recreational activities.
- Limited number of recreational open spaces, which need to be retained and enhanced.
- Opportunities for the Tame Way footpath to be further promoted.
- Opportunities to encourage and contribute to urban regeneration by developing recreation opportunities which focus on the river corridor.

5.8 Archaeology and Cultural Heritage

A detailed archaeological desk based study⁵ was undertaken for the purposes of the Strategy, which focussed on a 2 kilometer wider corridor, centred on the River Tame. All known heritage resources within 1 kilometer of the river were identified. In addition the wider catchment area of the Tame was assessed in terms of its geoarchaeological significance.

5.8.1 Sites of National Importance

Nationally important sites include Scheduled Monuments, Registered Parks and Gardens and Listed Buildings.

A total of 14 Scheduled Monuments are present within the study area, as listed in Table 7. These are scheduled sites of national importance and as such are statutorily protected.

Table 7: Scheduled Monuments within the study area

Map Reference No.	Scheduled Monument
1	Chances Glassworks, Smethwick
2	Perry Bridge
3	Bromwich Castle
4	Water Orton Bridge
5	Drakenage Farm, Moated Site and Medieval Fish Ponds
6	Kingsbury Hall
7	Tamworth Castle
8	Medieval Deanery, Lower Gungate
9	Saxon Defences x 2*
10	The Low Bowl Barrow
11	Air Photographic Site SW of Elford
12	Settlement sites and enclosure 460m NE of Sittles Farm
13	Site of round barrow near River Tame

* Two Scheduled Monuments

⁵ River Tame Catchment Level 1 Archaeological Desk Based Assessment. May, 2008. Birmingham Archaeology.

There are four registered parks and gardens within 1 kilometer buffer of the River Tame. These are listed in Table 8 below.

Table 8: Historic Parks and Gardens within the study area

Map Reference No.	Scheduled Monument
1	Brunswick Park
2	Witton Cemetery
3	Aston Hall
4	Castle Bromwich Hall

There are many listed buildings within the study area, again shown on Figure 7.

The remaining cultural heritage resources within the study area totalled 974 within the regional historic environment record and 591 within the national historic environment record (although some features may be included on both records).

The key areas of importance are discussed below.

5.8.2 *Key areas of archaeological significance*

Known heritage features dating from between 972 and 1562 are recorded along the 2 kilometer wide study corridor of the Tame Strategy. Most are concentrated toward the confluence of the Tame and Trent, with densities of medieval and earlier sites at their lowest toward Birmingham, West Bromwich, Sandwell and Dudley. The lack of records in this area is however likely to be as much an indication of the lack of open area archaeological investigation in the Birmingham conurbation rather than a true reflection of a reduced risk. At the Tame Trent confluence archaeologists have had the opportunity of looking for remains in open gravel quarry sites, where even the most subtle deposits can be identified. Working on smaller developments in Birmingham's suburbs provides a much less favourable opportunity to spot features or finds; the lack of recorded sites in these areas may reflect this.

While palaeochannels are less common on the Tame than for example on the Trent. However, a series of palaeochannels have been identified and are of significant potential. They represent one of the few places where organic environmental remains will survive in this landscape and so are of heightened archaeological importance. These areas are likely to impact upon the choice of mitigation strategy.

The Birmingham conurbation has a higher potential for more recent archaeological remains, particularly those associated with the industrial revolution. As the process of

world wide industrialisation began in this location there is the potential for some of these more recent sites to be of great heritage value.

Within the Tame catchment there is a recurring risk of encountering medieval moated sites, close to the line of the Tame. The Tame catchment has one of the highest concentrations of moated sites nationally and so these features should be regarded as a significant risk.

CULTURAL HERITAGE KEY ISSUES

- A number of statutorily protected sites are present within 1 kilometer of the River Tame.
- The area between Tamworth and the confluence with the Trent provided the greatest concentration of archaeological material, spread across several archaeological periods. The relative importance of this area diminished over periods later than the Medieval.
- Scattered activity from all periods has been recorded in the conurbations of Birmingham and the Black Country, though the distribution of such activity is difficult to ascertain for periods earlier than the Medieval.
- The western portion of the study area (West Bromwich, Oldbury and Sandwell) is of particular importance in regards to the post medieval industrial history of the West Midlands, with several of the primary transport links, mineral extraction and production centres of the Industrial Revolution within the region present within the study area.
- The area showing the lowest concentration of archaeological material across the periods lies between Coleshill and Tamworth, although significant individual features are still present in this area.
- Alteration of watercourse levels can be advantageous or damaging to historic structures.
- In both urban and rural areas many archaeological sites lie close to the surface and are vulnerable to disturbance by groundworks.

6 Assessment of Environmental Effects and Evaluation of Impact Significance

In this chapter, we consider the significance of the effects of the short-list of strategic options for the Tame Strategy.

6.1 Introduction

This section provides information on the environmental effects of the options proposed for management of flood risk within the Tame catchment.

Each option is assessed by evaluating how implementing the option will affect the SEA objectives, as listed in table 1. The environmental assessment methodology is described further in Section 2.5.1.

Our assessment process was carried out in two main stages:

- Firstly we carried out a broad assessment of a large list of potential options in order to narrow down our list of suitable options;
- Secondly we modelled each of the shortlisted options. The modelling provided predicted flood outlines, for each option and we used these outlines, in combination with our knowledge of how the option could be implemented, to assess the detailed impacts of each option.

6.2 Options Analysis – Stage 1: Broad Assessment

We have a broad set of options that we use to manage flood risk across the country.

These include:

- Using areas to store floodwater during flood events;
- Improving the conveyance or flow of the river water to prevent flooding from water being restricted (e.g. by structures, channel capacity);
- Using flood defences to protect specific areas from flooding;
- Policy and planning controls (e.g. to prevent development in the floodplain, to reduce surface water runoff etc.).

We used these broad types of options as a starting point, and identified more specific options that would be appropriate to different locations within the Tame catchment. A total of 29 potential options were identified through a combination of mind-mapping sessions with our own specialists, the project team and external consultees.

These 29 options are listed below:

- Do nothing
- Do minimum
- Re-engineer / re-design existing defences
- Raise existing defences
- Use temporary defences
- Utilise third party structures as flood defences
- Optimise use of existing storage
- Increase existing storage areas
- Create new storage areas
- Utilise lakes at Lea Marston
- Tributary storage
- Create bypass/ relief channels
- Open up culverts
- Enlarge bridges / remove obstructions
- Dredge/ de-silt river
- Enlarge channels (including set back defences e.g. to flood agricultural land)
- Sign more people up to FWD
- Use planning controls to limit redevelopment of land within floodplain and promote 'Blue Corridor'
- Improve sewerage network to increase storage
- Use canal as flood storage channel
- Alter farming / land management practices to reduce runoff
- Promote greater use of SUDS to reduce surface water run-off
- Investigate opportunities for flood storage associated with aggregate workings restoration
- Improve warning / flood proofing information for new developments in floodplain
- Increase Infiltration - building design, green roofs, permeable land cover
- Flood Resilience measures to properties
- Development Control - prevent inappropriate development in the floodplain
- Improved Management of Flood Events
- Use roads as a carrier - manage flow on roads to carry water and then allow back to river

These options were then initially screened for their feasibility using environmental, technical and economic considerations. We used two high level technical objectives, two environmental objectives and one economic objective for this process, as detailed in the following bullet points:

- **Technical objective 1:** Is the option likely to reduce flood risk and / or flood damage caused by the River Tame?
- **Technical Objective 2:** Is this option something that could be promoted within the remit of the Tame Strategy?
- **Economic Objective 1:** Are the costs associated with the option broadly comparable with the benefits in terms of flood damages avoided?
- **Environmental Objective 1:** Is the option likely to cause significant environmental impacts that could not be mitigated?
- **Environmental Objective 2:** Is there potential for the option to be sustainable?

Following this initial screening exercise, options were either taken forward for further assessment and investigation, or rejected.

The full results of this assessment exercise are given in Appendix C. The tables in Appendix C show the initial 29 options that were identified (IO 1 – IO29). The five screening objectives are also shown, and our assessment of each option against each objective is described in text. We also show which options should be taken forward for further assessment and our reasons for this decision.

(a) Options rejected:

The options that were rejected from being taken forward for further assessment, because of either technical, economic or environmental reasons, are listed below. Further details are provided in Appendix C.

- Utilise lakes at Lea Marston;
- Dredge/ de-silt river;
- Use canal as flood storage channel;
- Alter farming / land management practices to reduce runoff; and
- Use roads as a carrier - manage flow on roads to carry water and then allow back to river.

(b) Options taken forward:

The options that were taken forward for further assessment and modelling of their potential impacts are outlined below. These options were grouped into eight main options (some of which had a number of sub-options):

- Option 1: Do Nothing;
- Option 2: Do Minimum;
- Option 3: Maintain existing level of flood risk management;
- Option 4: Optimise use of existing storage areas;
- Option 5: Increase existing flood storage:
 - Increase existing storage areas;
 - Create new storage areas on River Tame;
 - Create new storage areas on tributaries;
- Option 6: Localised improvements to flood risk
 - Re-engineer / re-design existing defences;
 - Raise existing defences;
 - Use temporary defences;
 - Utilise third party structures as defences;
 - Create bypass/ relief channels;

- Open up culverts
- Enlarge channels (e.g. set back defences to flood e.g. agricultural land);
- Option 7: Enlarge bridges/ remove obstructions
- Option 8: Policy and planning controls:
 - Sign more people up for flood warning;
 - Use planning controls to limit development in floodplain;
 - Promote greater use of SUDS to reduce surface water runoff;
 - Investigate opportunities for flood storage associated with aggregate workings;
 - Improve warning / flood-proofing for new developments in flood plain;
 - Increase infiltration through building design (e.g. green roofs etc.)
 - Improve flood resilience of properties;
 - Prevent inappropriate development in floodplain;
 - Improved management of flood events.

The Do Nothing option means that we will stop all of our maintenance work to the existing flood defences and the river channel. Therefore over time the existing flood defences will fail and the channel may become blocked. The Do Minimum option means that we will continue with our maintenance work to the river channel and to the existing flood defences until they reach the end of their design life. However once a defence reaches the end of its design life it is assumed under this option that we will not replace it. It is necessary to assess the impacts of the Do Nothing and Do Minimum options, as these provide a baseline against which the remaining options can be assessed. These were therefore taken forward as Options 1 and 2 respectively.

The next option (Option 3) was to maintain the existing level of flood risk management, through continuing our existing river maintenance work and replacing the existing flood defences with a like for like substitution as the defences fail.

As the risk of flooding in some areas of the catchment is high modelling was then undertaken to assess how different options could be used to reduce the risk of flooding.

As described in Section 1.2.2, there are a number of existing flood storage areas in the upper Tame catchment. We firstly modelled an option in which the operation of these existing storage areas was optimised (Option 4). An option to increase the floodplain storage, by creating new areas or extending existing areas both on the River Tame and its tributaries (Option 5) was modelled. Finally, the combination of optimising the existing

storage with implementing additional localised improvements (Options 6 and 7) was modelled⁶. These localised improvements could take the form of any of the sub-options listed under Options 6 and 7 above.

It is not possible to model the effects of Option 8 (Policy and Planning Controls). It is also unlikely that these options alone will provide adequate long term solutions for the long term management of flood risk. However, these options may be applicable in certain areas of the catchment and therefore the Strategy will seek to promote these options in appropriate geographical areas.

In summary, the options that were therefore taken forward for detailed reach-by-reach technical, environmental and economic assessment were:

- Option 1: Do Nothing;
- Option 2: Do Minimum;
- Option 3: Maintain existing level of flood risk management;
- Option 4: Optimise existing storage;
- Option 5: Increase storage;
- Option 6: Localised improvements.

⁶ Option 6 comprised localised improvements to defences (i.e. increasing defence heights or constructing new defences). For modelling purposes, an additional option (Option 7) was modelled. This comprised additional improvements to bridges/ culverts in combination with the localised improvements to defences. For simplicity these have both been referred to as “Option 6 localised improvements” in the following sections, though it has been specifically stated whether these improvement comprise improvements to defences alone, or in-combination with works to bridges/ culverts.



6.3 Options Analysis – Stage 2: Detailed Assessment

6.3.1 Assessment process

In order to assess the environmental impacts of implementing each of the six options in detail we used a combination of:

- the resultant flood outlines that would occur if the option was implemented (produced by the flood modelling work); and
- information on how and where the option would practically be implemented.

In general we used the predicted flood outline for a flood event with a 1 % probability of occurring in a year, to identify any receptors that would be at risk from flooding. Information on how and where the option would be implemented included information on, for example, the locations and heights of proposed flood defences, the locations of any bridges or culverts that would be removed the locations of any proposed new flood storage areas etc.

In order to assess the impacts in detail, we split the catchment into 35 individual flood cells. These boundaries of these cells were derived primarily based on the flood outlines

of the current 1 % probability flood. For each flood cell we assessed how the impact of implementing each of the six options would affect the environment, by looking at the effect on each of the SEA objectives and sub-objectives detailed in Table 1.

The detailed results of this assessment are provided in the tables at the end of the report. We have summarised the results of the detailed analysis of the impacts of each option for each flood cell in the tables in Appendix D. These summary results allow us to identify the preferred option for each flood cell from an environmental perspective. We have also indicated the preferred option for each flood cell from an economic and technical perspective.

6.3.2 Selecting the preferred Strategy option

The overall preferred Strategy option needs to take into account technical and economic considerations, as well as the environmental issues. In order to make presentation of the results clearer, we have combined the 35 flood cells into 9 larger reaches. The boundaries of these reaches were derived based on geographical areas and the flood outlines of the current 1 % probability flood.

The link between the flood cells and the reporting reaches is shown in table 13 and also on Figures 1a-j.

Table 9: Flood cells contained within each reach

Reach	Flood Cells
1 (Oldbury Arm)	1-9
2 (Willenhall Arm)	10-11
3 (Bescot Junction)	12
4 (Newton and Hamstead)	13-16
5 (Perry Barr and Witton)	17-21
6 (Gravelly Hill and Bromford)	22-23
7 (Water Orton, Lea Marston and Kingsbury)	24-30
8 (Fazeley and Tamworth)	31-34
9 (Comberford to Arlewas)	35

In this section, we present the preferred option that has been selected (based on technical, environmental and economic consideration) for each reach. As each reach generally contains more than one flood cell, the preferred option is a combination of a number of options that will be implemented in different areas (or flood cells).

(a) Reach 1



Table 10: Summary of significant high level environmental impacts of each option in Reach 1

Option	Significant environmental impacts
1	<p>Major adverse impact on human health/ population due to significant increase in number of properties at risk.</p> <p>Moderate adverse impact on recreation and amenity due to increased frequency of flooding of large area of Sheepwash Urban Park.</p>
2	<p>Moderate adverse impact on human health/ population due to moderate increase in number of properties at risk.</p> <p>Minor adverse impact on recreation and amenity as only small area of Sheepwash Urban Park impacted by increased frequency of flooding.</p>
3	No moderate or major impacts.
4	No storage areas to be optimised.
5	Moderate beneficial impact on biodiversity due to creation of increased storage area at Sheepwash LNR.
6	<p>Moderate beneficial impact on human health/ population due to reduction in number of properties at risk from 305.</p> <p>Moderate adverse impact on landscape / visual amenity due to construction of ~ 1500m new/raised defences.</p>

Environmental considerations

The favoured option from an environmental perspective would be a combination of Option 5 (increased storage) and Option 6 (localised improvements). Option 6 would generally be the favoured option in the cells in which there are significant numbers of properties and / or infrastructure at risk from flooding (flood cells 1, 4, 6 & 9). Option 5 would be the favoured option in the remaining cells due to the potential biodiversity benefits associated with this option.

Technical considerations

Option 5 cannot be justified as the favoured option on technical grounds, as the new storage areas that are potentially available are not large enough to obtain significant reductions in flood risk.

Economic considerations

Option 6 can be justified as the favoured option in some cells where the numbers of properties at risk from flooding is high. However in other cells it is not cost beneficial to select this as the favoured option, and in these cells Option 3 is preferred.

The proposed preferred option for Reach 1, taking into account environmental, technical and economic considerations is therefore **a combination of Option 3: maintain existing level of flood risk management; and Option 6: localised improvements to defences in flood cells 1, 2, 6 and 9.**

(b) Reach 2



Table 11: Summary of significant high level environmental impacts of each option - Reach 2

Option	Significant environmental impacts
1	<p>Major adverse impact on human health/ population due to significant increase in number of properties at risk.</p> <p>Major adverse impact on infrastructure due to potential inundation of railway and Willenhall STW.</p>
2	<p>Major adverse impact on infrastructure due to potential inundation of railway.</p>
3	<p>Major adverse impact on infrastructure due to potential inundation of railway.</p>
4	<p>No suitable storage areas to be optimised.</p>
5	<p>Locations for storage areas unlikely to provide significant biodiversity benefits.</p>
6	<p>Moderate beneficial impact on infrastructure due to protection of Willenhall STW and railway.</p> <p>Moderate adverse impact on landscape / visual amenity due to construction of ~ 850m new/raised defences.</p>

Environmental considerations

The favoured option from an environmental perspective would be a combination of Option 2 (do minimum) and Option 6 (localised improvements). In the upper part of the reach there is minimal difference between the options, though option 2 has marginally greater environmental benefits. Option 6 is favoured in the lower reach, as it would protect key infrastructure from flooding.

Economic considerations

Option 6 cannot be justified as the favoured option on economic grounds, as protection of infrastructure is not the duty of the Environment Agency.

The proposed preferred option for Reach 2, taking into account environmental, technical and economic considerations is **Option 3: maintain existing level of flood risk management.**

(c) Reach 3



Table 12: Summary of significant high level environmental impacts of each option - Reach 3

Option	Significant environmental impacts
1	<p>Moderate adverse impact on human health/ population due to moderate increase in number of properties at risk.</p> <p>Major adverse impact on infrastructure due to potential inundation of railway.</p>
2	<p>Major adverse impact on infrastructure due to potential inundation of railway.</p>
3	<p>Major adverse impact on infrastructure due to potential inundation of railway.</p>
4	<p>No suitable storage areas to be optimised.</p>
5	<p>No suitable areas for new storage.</p>
6	<p>Moderate beneficial impact on recreation and amenity due to protection of Bescot Stadium approach and other recreation areas from flooding.</p> <p>Major beneficial impact on infrastructure due to protection of railway from flooding.</p> <p>Major adverse impact on landscape / visual amenity due to construction of ~ 1000m new/raised defences.</p>

Environmental, technical and economic considerations

The favoured option from an environmental, technical and economic perspective would be Option 6 (localised improvements).

Option 6 is the proposed preferred option as it would result in protection of both properties and infrastructure which is at risk from flooding.

(d) Reach 4

Table 13: Summary of significant high level environmental impacts of each option - Reach 4

Option	Significant environmental impacts
1	<p>Moderate adverse impact on human health/ population due to moderate increase in number of properties at risk.</p> <p>Moderate adverse impact on recreation/ amenity due to inundation of large area of Sandwell Valley and Perry Hall recreation areas.</p> <p>Major adverse impact on infrastructure due to potential inundation of railway, sections of Ray Hall STW.</p>
2	<p>Moderate adverse impact on human health/ population due to moderate increase in number of properties at risk.</p> <p>Moderate adverse impact on recreation/ amenity due to inundation of large area of Sandwell Valley and Perry Hall recreation areas.</p> <p>Major adverse impact on infrastructure due to potential inundation of railway, sections of Ray Hall STW.</p>
3	<p>Major beneficial impact on infrastructure due to removal of Ray Hall STW from flood extent.</p>
4	<p>Major beneficial impact on infrastructure due to removal of Ray Hall STW from flood extent.</p>
5	<p>Minor adverse impact on biodiversity due to potential for increased water levels associated with a modified Sandwell Valley RSPB reserve/ Forge Mill LNR flood storage area.</p>
6	<p>Moderate adverse impact on landscape and visual amenity due to construction of ~1000m of new / raised defences.</p>

Environmental considerations

The favoured option from an environmental perspective would be a combination of Option 3 (maintain existing level of flood risk management) in the upper reach and Option 4 (optimise the existing function of the storage areas at Forge Mill and Perry Hall) in the lower reach, due to the removal Ray Hall STW from the flood extent.

In this reach the proposed preferred option, taking into account environmental, technical and economic considerations, is a combination of **Option 3 (maintain existing level of flood risk management) and Option 4 (optimise the existing functioning of the storage areas at Forge Mill and Perry Hall).**

(e) Reach 5



Table 14: Summary of significant high level environmental impacts of each option - Reach 5

Option	Significant environmental impacts
1	<p>Major adverse impact on human health/ population due to significant increase in number of properties at risk.</p> <p>Moderate adverse impact on recreation/ amenity due to inundation of large area of Salford Park.</p>
2	<p>Major adverse impact on human health/ population due to significant increase in number of properties at risk.</p> <p>Moderate adverse impact on recreation/ amenity due to inundation of large area of Salford Park.</p>
3	<p>Major adverse impact on human health/ population due to significant increase in number of properties at risk.</p> <p>Moderate adverse impact on recreation/ amenity due to inundation of large area of Salford Park.</p>
4	No suitable storage areas to be optimised.
5	No suitable areas for new storage.
6	Major beneficial impact on human health/ population due to reduction

	<p>in significant number of properties at risk from flooding.</p> <p>Moderate beneficial impact on recreation/ amenity due to protection of Salford Park recreation area.</p> <p>Moderate beneficial impact on infrastructure due to protection of sections of railway.</p> <p>Major adverse effect on landscape / visual amenity due to construction of ~8000m of new /raised defences.</p>
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Environmental considerations

The favoured option from an environmental perspective would be a combination of Option 6 (localised improvements) and Option 2 (do minimum). Option 6 is generally preferred as it would protect property and infrastructure that is at risk from flooding.

Technical and economic considerations

Option 6 cannot be justified in all flood cells on technical and economic grounds.

The proposed preferred option, taking into account environmental, technical and economic considerations, is a combination of **Option 3 (maintain existing level of flood risk management) and Option 6 (localised improvements) in flood cells 17, 19 and 20.**

(f) Reach 6



Table 15: Summary of significant high level environmental impacts of each option - Reach 6

Option	Significant environmental impacts
1	<p>Major adverse impact on human health/ population due to significant increase in number of properties at risk.</p> <p>Major adverse impact on infrastructure due to potential inundation of gas works and railway.</p>
2	<p>Major adverse impact on human health/ population due to significant increase in number of properties at risk.</p> <p>Major adverse impact on infrastructure due to potential inundation of gas works and railway.</p>
3	<p>Major adverse impact on human health/ population due to significant number of properties at risk.</p> <p>Major adverse impact on infrastructure due to potential inundation of gas works and railway.</p>
4	No suitable storage areas to be optimised.
5	No suitable areas for new storage.

6	<p>Major beneficial impact on human health/ population due to significant reduction in number of properties at risk.</p> <p>Major beneficial impact on infrastructure due to protection of railway and gas works from flooding.</p> <p>Major adverse effect on landscape / visual amenity due to construction of ~8000m of new /raised defences.</p>
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Environmental considerations

The favoured option from an environmental perspective would be Option 6 (localised improvements). This would be preferred as it would result in protection of significant numbers of properties, infrastructure and cultural heritage assets.

Technical and economic considerations

Option 6 cannot be justified in all flood cells on technical and economic grounds as protection of infrastructure is not the duty of the Environment Agency.

The proposed preferred option, taking into account environmental, technical and economic considerations, is a combination of **Option 3 (maintain existing level of flood risk management)** and **Option 6 (localised improvements) in flood cell 23**.

(g) Reach 7



Table 16: Summary of significant high level environmental impacts of each option - Reach 7

Option	Significant environmental impacts
1 & 2	<p>Major adverse impact on human health/ population due to significant increase in number of properties at risk.</p> <p>Major adverse impact on infrastructure due to potential inundation of STWs and railway.</p> <p>Major adverse impact on archaeology and cultural heritage due to inundation of SM.</p> <p>Major adverse impact on recreation/amenity due to inundation of large area of Kingsbury Water Park.</p> <p>Moderate adverse impact on landuse due to inundation of Grade 3 ALC / ESS land.</p> <p>Moderate adverse impact on water quality due to inundation of STW.</p>
3	<p>Major adverse impact on human health/ population due to significant number of properties at risk.</p> <p>Moderate adverse impact on infrastructure due to potential inundation</p>

	<p>of sections of STW and railway.</p> <p>Major adverse impact on archaeology and cultural heritage due to inundation of SM.</p> <p>Major adverse impact on recreation/amenity due to inundation of large area of Kingsbury Water Park.</p> <p>Moderate adverse impact on landuse due to inundation of Grade 3 ALC / ESS land.</p> <p>Moderate adverse impact on water quality due to inundation of STW.</p>
4	No suitable storage areas to be optimised.
5	Major beneficial impacts on biodiversity due to creation of additional habitat adjacent to Whitacre Heath, River Blythe SSSI.
6	<p>Moderate beneficial impact on human health/ population due to reduction in number of properties at risk.</p> <p>Major beneficial impact on infrastructure due to protection of STW and railway.</p> <p>Major adverse impact on recreation/amenity due to inundation of large area of Kingsbury Water Park.</p> <p>Moderate adverse impact on landuse due to inundation of Grade 3 ALC / ESS land.</p> <p>Moderate adverse effect on landscape / visual amenity due to construction of ~2500m of new /raised defences.</p>

Environmental considerations

The favoured option from an environmental perspective would be a combination of Option 3 (maintain existing level of flood risk management), Option 5 (increased storage) and Option 6 (localised improvements).

Option 6 would be favoured in the areas where there is significant infrastructure (and properties (flood cell 28)) at risk from flooding. In the lower reach, significant biodiversity and recreation benefits could be achieved through the creation of new areas of floodplain storage as part of Option 5, particularly associated with existing wetland sites, such as Whitacre Heath and Park Hall Nature Reserve.

Technical considerations

Option 6 cannot be justified in all flood cells on technical grounds as protection of infrastructure is not the duty of the Environment Agency. Option 5 cannot be justified on technical grounds as modelling indicates that the potential floodplain storage areas will not result in significant reductions in flood risk downstream.

Economic considerations

Option 6 cannot be justified in all flood cells on economic grounds as protection of infrastructure is not the duty of the Environment Agency.

The proposed preferred option, taking into account environmental, technical and economic considerations, is therefore **a combination of Option 6 (localised improvements) in flood cell 28, and Option 3 (maintain existing level of flood risk management) in the remaining flood cells.**

(h) Reach 8



Table 17: Summary of significant high level environmental impacts of each option - Reach 8

Option	Significant environmental impacts
1	<p>Major adverse impact on human health/ population due to significant increase in number of properties at risk.</p> <p>Moderate adverse impact on archaeology and cultural heritage due to inundation of 10 listed buildings.</p> <p>Moderate adverse impact on recreation/amenity due to inundation of large area of Middleton Lakes RSPB reserve.</p> <p>Moderate adverse impact on landuse due to inundation of Grade 2 ALC / ESS land.</p>
2	<p>Major adverse impact on human health/ population due to significant increase in number of properties at risk.</p> <p>Moderate adverse impact on archaeology and cultural heritage due to inundation of 8 listed buildings.</p> <p>Moderate adverse impact on recreation/amenity due to inundation of large area of Middleton Lakes RSPB reserve.</p>

	Moderate adverse impact on landuse due to inundation of Grade 2 ALC / ESS land.
3	<p>Moderate adverse impact on human health/ population due to moderate number of properties at risk.</p> <p>Moderate beneficial impact on archaeology and cultural heritage due to protection of all listed buildings and SMs.</p> <p>Moderate adverse impact on landuse due to inundation of Grade 2 ALC / ESS land.</p>
4	No suitable storage areas to be optimised.
5	Major beneficial impacts on biodiversity due to creation of additional habitat in two key areas.
6	<p>Major beneficial impact on human health/ population due to reduction in number of properties at risk.</p> <p>Moderate beneficial impact on archaeology and cultural heritage due to protection of all listed buildings and SMs.</p> <p>Moderate adverse impact on landuse due to inundation of Grade 3 ALC / ESS land.</p> <p>Moderate adverse effect on landscape / visual amenity due to construction of ~3000m of new /raised defences.</p>

Environmental considerations

The favoured option from an environmental perspective would be a combination of Option 6 (localised improvements) and Option 5 (increased storage).

Option 6 would be favoured in the areas where there is significant numbers of properties at risk from flooding. Significant biodiversity and recreation benefits could be achieved through the creation of new areas of floodplain storage as part of Option 5, particularly associated with the existing RSPB reserve at Middleton Lakes.

Technical considerations

Option 5 cannot be justified on technical grounds as modelling indicates that the potential floodplain storage areas will not result in significant reductions in flood risk downstream.

The proposed preferred option, taking into account environmental, technical and economic considerations, is therefore Option 3 (maintain existing level of flood risk management) and Option 6 (localised improvements) in flood cells 31 and 33, which have the greatest numbers of properties at risk.

(i) Reach 9



Table 18: Summary of significant high level environmental impacts of each option - Reach 9

Option	Significant environmental impacts
1	<p>Major adverse impact on human health/ population due to significant increase in number of properties at risk.</p> <p>Moderate adverse impact on recreation/amenity due to inundation of large area of National Memorial Arboretum.</p> <p>Major adverse impact on landuse due to inundation of Grade 2 ALC / ESS land.</p> <p>Major adverse impact on archaeology and cultural heritage due to inundation of 3 SMs and number of listed buildings.</p>
2 & 3	<p>Moderate adverse impact on human health/ population due to moderate increase in number of properties at risk.</p> <p>Moderate adverse impact on recreation/amenity due to inundation of large area of National Memorial Arboretum.</p> <p>Major adverse impact on landuse due to inundation of Grade 2 ALC / ESS land.</p>

	Major adverse impact on archaeology and cultural heritage due to inundation of 3 SMs and number of listed buildings.
4	No suitable storage areas to be optimised.
5	No suitable areas for new storage.
6	<p>Major beneficial impact on human health/ population due to reduction in number of properties at risk.</p> <p>Moderate adverse impact on recreation/amenity due to inundation of large area of National Memorial Arboretum.</p> <p>Major adverse impact on landuse due to inundation of Grade 2 ALC / ESS land.</p> <p>Major adverse impact on archaeology and cultural heritage due to inundation of 3 SMs and number of listed buildings.</p>

Environmental considerations

The favoured option from an environmental perspective would be Option 6 (localised improvements, as it would have beneficial impacts on properties, infrastructure and amenity sites at risk from flooding).

Economic considerations

Option 6 cannot be justified on economic grounds as protection of infrastructure and recreational sites is not the duty of the Environment Agency.

The proposed preferred option taking into account environmental, technical and economic considerations, is therefore Option 3 (maintain existing level of flood risk management).

6.3.3 Environmental impacts of preferred option

Once we had selected the preferred option (or combination of options) for each reach, we then assessed the significant environmental impacts of implementing that preferred option. It must be noted that these will not be the same as those outlined in Table 10 to Table 18 above, as the combinations of options to be implemented in different geographical locations within a reach will result in different environmental impacts than would occur if a single option was implemented throughout the whole reach.

In the following tables, we describe the significant environmental impacts of implementing the preferred option (or combination of options) in each reach. Where necessary we have also described any necessary mitigation measures as well as outlining the environmental enhancement opportunities that are associated with the preferred option.

(a) Climate change

Once the preferred option (or combination of options) had been selected for each reach we also carried out a sensitivity analysis, to see how the likely impacts of climate change would affect the option, and whether there would be a need to undertake further work. For this work we have assumed that the impacts of climate change would take effect from 2025.

In the tables that follow, we have described the way in which we propose to deal with the likely effects of climate change, and have also described the environmental impacts both pre 2025, with the preferred option in place, and post 2025, with any additional climate change actions also in place.

It must be noted that there is a greater degree of uncertainty associated with the predicted impacts after 2025.