Bristol City and South Gloucestershire Councils

AVONMOUTH AND SEVERN SIDE INTEGRATED DEVELOPMENT, INFRASTRUCTURE AND FLOOD RISK MANAGEMENT STUDY

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This report has been prepared for the sole benefit, use and information of SWRDA, Bristol City Council and South Gloucestershire Council for the purposes set out in the report or instructions commissioning it. The liability of WYG in respect of the information contained in the report will not extend to any third party.
Executive Summary

Bristol City and South Gloucestershire Councils have set out a strong vision for the economic development of the Avonmouth/Severnside area (see plan of study area on page 3 and at Appendix 1). The objective is to ensure that the area remains an internationally significant industrial location that attracts business and provides substantial employment. The Councils want to ensure a positive approach to planning and investment in infrastructure that will unlock the area’s full potential. This report and the separate report “Avonmouth Severnside Outline Development Strategy” seek to set out a positive way forward to unlock the area’s full potential.

Although current planning policies take a cautious approach to the area’s development potential to 2026 and beyond, the Councils’ ambition is for substantial economic development in the study area. The current development plans for the area acknowledge the challenges that the area faces and seek to encourage solutions that will ensure that the area remains an important business location.

This report seeks to identify and explore the challenges to the area’s development and to identify a viable way forward that will ensure that existing infrastructure and development in the area remains sustainable and that the area achieves its full potential. It explores the key challenges of:

- flood risk;
- ecology; and
- transport; and

sets out opportunities for addressing these.

The report also explores the planning history and policy background in the study area and other challenges including the presence of hazardous installations, heritage and archaeology and landscape. The desire to ensure that the area is able to fulfil its economic development potential will inevitably require a careful balancing of some of these issues with the need to bring forward economic development.

Our conclusions in respect of the study area’s development potential are that:

- the continuing economic development of about 350 ha of green field land within the 57/58 planning permissions could generate significant employment opportunities in the area;
- the development of a further 60ha of green field land within the study area could be feasible;
• however it will be necessary to reduce the increasing risk of (tidal) flooding within the area at an estimated cost of £59.8 million to facilitate the area’s economic development and to better protect existing development and infrastructure;

• it will also be necessary to mitigate the impacts of development on the area’s important ecology by setting land in the area side for habitat enhancement at a cost of about £5 million;

• the Councils also wish to see the development of a new junction on the M49 to enhance the area’s attractiveness for business and to mitigate the transport impacts of development in the area;

• a comprehensive approach to dealing with the area’s challenges is important to avoid piecemeal development that increases the risk of flooding elsewhere, harms the area’s ecology and has an adverse impact on the area’s transport infrastructure;

• further detailed studies will be required to confirm details and costs of the flood defence, transport and ecology options, including, if appropriate, proposals for the phasing of those options.

If the existing challenges are addressed in the period to 2050, there is the potential to bring forward sustainable economic development that could provide:

• more than 60 ha of additional green field land for economic development;

• more than 1.1 million square metres of floorspace for B1 (excluding offices), B2, B8 and sui generis uses on green field and previously developed land;

• associated new employment opportunities that are assessed in the separate Avonmouth Severnside Outline Development Strategy report;

with investment in appropriate infrastructure and mitigation solutions with costs that depend on the options chosen.

Finally, a separate section of the report examines the area’s potential for district heating. There is considerable potential for heat generation within the area and a number of potential heat anchors that could serve to attract potential occupiers with a high heat or cooling demand and the development of a district heating system. However, the opportunity to develop a district heating system will depend on the demand for heating and cooling from end users.
1.0 Introduction

1.1 The Opportunity

1.1.1 The study area is of huge importance to the economy of the region and beyond. It accommodates a wide range of businesses, particularly in the areas of storage and distribution and energy and waste. It also includes Bristol Port that has proposals to expand with the development of a new Deep Sea Container Terminal. About 14,000 people are employed in the area and it accommodates infrastructure (including energy generation, sewage treatment, waste processing, liquid natural gas storage and distribution networks of pipelines and cables) that is of economic importance to a wide area.

1.1.2 However, the area’s development potential is challenged by a variety of factors including:
- an increasing risk of flooding, particularly tidal flooding;
- limited motorway connectivity, despite the proximity of the motorway network;
- ecological designations of European significance; and
- extant planning permissions granted in 1957/58 that could lead to development of much of the Severnside area without the infrastructure that could help deliver an optimum solution.

1.1.3 These factors need to be addressed to help ensure that the area is able to meet its full potential. The Councils recognise the need to work together and with other stakeholders (including the Local Enterprise Partnership (LEP), land owners and businesses) to effectively accommodate the demand for economic development in the area. This report therefore seeks to set out how these factors could be addressed to enable the area to retain its international significance. This report also examines the potential cost of addressing the challenges.

1.1.4 A separate report “Avonmouth Severnside Outline Development Strategy” illustrates how the costs of addressing the challenges could provide value for money.

1.2 WYG

1.2.1 WYG has been commissioned as the Lead Consultant to undertake this study on behalf of Bristol City and South Gloucestershire Councils.

1.2.2 WYG has provided technical advice to support this commission in respect of planning, transport and ecology and has been supported by the following consultants:
- Buro Happold – Flood Risk and District Heating; and
- Amion Consulting – Economic Appraisal and Funding.

1.2.3 This report brings together the various areas of technical work that have been undertaken by the study team to seek to identify an optimum development scenario for the study area in the period to 2050. An integrated approach is required to address the issues highlighted in paragraph 2.1.2.
1.2.4 The report seeks to set out the constraints that have hindered development in the area to date and to identify a comprehensive strategy for addressing those constraints. The strategy seeks to help bring forward the economic development of:

- previously developed land;
- the substantial parts of the area that already benefit from planning permissions; and
- additional green field land;

to enable the realisation of the area’s full potential.

1.2.5 This report feeds into and should be read in conjunction with the separate report: “Avonmouth/Severnside Outline Development Strategy”. Although this report identifies the current constraints to development and the costs to address these, the separate report considers the alternative options for realising the Vision and opportunity that the area provides and assesses the benefits and value for money of the elements of the Strategy.

1.2.6 This approach reflects the requirements of the Project Brief that focuses on seeking a solution to the challenges that have limited the area’s development to date and that will continue to constrain its future unless they are met.

1.3 Location

1.3.1 The extent of the study area is shown in the plan at page 3 and Appendix 1. It comprises:

- Bristol Port and its associated storage and distribution activities;
- the Avonmouth and Severnside industrial and warehousing areas at the northern and southern ends of the area;
- a central agricultural area; and
- infrastructure including power generation, waste recycling and disposal industries, a sewage water treatment facility, gas storage facilities, electric and gas transmission equipment.

1.3.2 The study area excludes the residential area of Avonmouth in the south and this report therefore focuses on economic development rather than the existing residential development. Residential development has not generally been permitted within the study area to date and it is unlikely to comprise a significant element of any future development strategy. However, addressing the constraints to the area’s economic development, including proposals to reduce the risk of flooding and improve transport links, will be of benefit to them too.

1.4 Infrastructure

1.4.1 The study area already includes substantial economic development and infrastructure. It comprises two main areas of economic development in the south (Avonmouth) and north (Severnside) of the area. Both areas predominantly comprise a mix of industrial, storage and distribution and sui generis uses.

1.4.2 The plan at Appendix 2 illustrates the extent of the developed parts of the study area and some of the infrastructure. The infrastructure installations within the area include:
Avonmouth and Severnside Infrastructure Study

- Bristol Port and its associated facilities;
- Seabank Power Station;
- wind turbines;
- Liquid Natural Gas (LNG) Plant;
- Sewage Treatment Works;
- passenger and freight railway lines;
- parts of the strategic highway network;
- waste treatment plants;
- surface water drainage infrastructure;
- overhead power lines;
- underground gas and oil pipelines; and
- formal and informal flood defences.

1.5 Challenges

1.5.1 Economic activity at Avonmouth and Severnside already makes a very substantial contribution to the economy of the Bristol and South Gloucestershire. It is important regionally and, in some respects, nationally and internationally. The area has seen considerable new development and redevelopment within recent years and there remains strong market/developer interest, including for very large format warehouse/logistics premises and for new recycling and energy projects.

1.5.2 The history of the area’s development includes planning permissions that were granted in 1957/58 (the 57/58 permissions) for the development of the (then) ICI chemical works in the Severnside area. Further details of the area’s planning history are outlined in section 3.0. However, at this stage, it is important to note that the 57/58 permissions remain extant and cover a substantial part of the Severnside area.

1.5.3 The area is however also the subject of significant environmental constraints including an increasing risk of flooding and its proximity to important nature conservation designations. The Councils are also concerned about the impact of additional development within the study area on transport infrastructure, the area’s archaeological potential and its landscape value.

1.5.4 The area’s constraints are reflected in current development plan policies that broadly seek to limit development to 2026 to a range of industrial, storage and waste uses involving the redevelopment of previously developed land together with an acknowledgement that much of the land that is the subject of the 57/58 permissions will continue to be developed for B2 and B8 uses.

1.5.5 The Councils would like to promote a more positive approach to the area’s economic development. The Councils have therefore, as part of this study, adopted a Vision for the study area (see paragraph 1.7.2) that seeks, inter alia, to unlock its full potential.
This study therefore seeks to identify options for addressing the constraints to development in the area to help release its full economic development potential. It seeks to identify the need for infrastructure and mitigation to accommodate further development and to address the threats to the area’s development, infrastructure and its economic potential.

The greatest challenge to the study area’s economic development potential is the increasing likelihood that, with the impact of climate change, the area will be subject to an increasing risk from tidal flooding. The SFRA 2 commissioned jointly by the Councils notes that if the existing flood defences are not improved, the risk of an increase in the frequency and severity of flooding in the future is such that existing and planned development in the area is unlikely to be sustainable. In the absence of a comprehensive flood mitigation strategy for the area, the SFRA 2 modelling suggests that development in the area will become increasingly at risk of flooding. A viable and sustainable solution to address the risk of flooding in the study will therefore be an essential component of any strategy for realising the area’s economic development potential.

Constraining Influence of Environmental Factors

The study seeks to set out options to address the constraining influence of environmental factors within the study area, principally the area’s risk of flooding, its ecological importance and its transport infrastructure. The study also refers to hazardous installations and the area’s heritage assets, including its historic landscape and archaeology.

The Brief

The Project Brief was prepared in consultation with officers within each Council and Natural England, the Highways Agency and Environment Agency.

Both Bristol City and South Gloucestershire Councils recognise the strategic importance of the area and have developed a draft joint Vision statement that sets out the key characteristics of the area to 2050:

An internationally significant industrial location, home to world-class companies operating in key sectors which are at the heart of the UK’s economic future, including advanced engineering, green & environmental technologies, tidal power and transport & logistics.

Business will be drawn by investment opportunities and a reputation for innovation, competitiveness and superb infrastructure including a deep-water container terminal providing direct access to road and rail networks from the closest port to the UK population with 45 million people living within 300 kilometres.

Local people will benefit from employment opportunities through established pathways, linking business, agencies, universities, schools and colleges working together to provide a highly skilled, adaptable workforce that maximises the benefits of economic growth and inclusion.

Through a positive approach to development planning and public investment in infrastructure that will unlock the area’s full potential, Avonmouth and Severnside will provide up to 7,500 new jobs;
helping to drive forward Bristol and the West of England as the UK’s most competitive city region, generating a wide range of jobs and significant local economic benefits.

An identification of the full potential developable area taking account of current core strategies but looking beyond the current plan period.

1.7.3 This Vision should be read alongside that set out in each Council’s Core Strategy. The Vision in the emerging South Gloucestershire Core Strategy (http://www.southglos.gov.uk/NR/exeres/99affbab-2714-4578-9d10-886983548a6c) states:

Severnside will remain a strategically important location for employment uses. Employers, landowners and developers will work with the Council, and other agencies and Bristol City Council to unlock economic potential and improve local transport infrastructure. The Severn Estuary and adjoining floodplain is internationally important for a wide range of ecology and will be safeguarded and maintained. Its archaeological heritage and interest will also be protected and conserved and a network of new nature reserves will be implemented. A longer term durable and robust strategy for addressing flood risk due to climate change will be adopted. The area’s potential for power generation will be managed.

1.7.4 The Vision for the Avonmouth area in the Bristol Core Strategy as adopted in 2011 (http://www.bristol.gov.uk/page/planning-core-strategy) states:

Avonmouth will maintain its status as a regionally important industrial and warehousing business location.

- The key economic sectors of environmental technologies, distribution and logistics, advanced engineering and aerospace and manufacturing will be encouraged.
- There will be an expanded role for the Port.
- Development will be carefully managed to avoid increased flood risk.
- Internationally important biodiversity will be safeguarded.

1.7.5 The Vision in the Project Brief sets a more positive tone for the area’s future economic development than the Visions in each Core Strategies that look forward to 2026 rather than 2050.

1.7.6 The Project Brief indicated a desire for both Councils to pursue a bid to the Regional Growth Fund and to create an Accelerated Development Zone (ADZ) and Tax Increment Funding (TIF) proposal to bring forward the further development of the area for key industries and enable the attendant mitigation and infrastructure. This study was intended to underpin these proposals and to:

- identify the optimum/appropriate balance between addressing constraints (and the mitigation costs);
  versus
- the economic benefits and employment potential of the whole Avonmouth Severnside area.
1.7.7 The broad requirements were to:

- identify the net developable area to 2050 (derived from an analysis of the constraints);
- provide an assessment of the employment potential of the area for B2/B8 uses derived from CLG guidance/ratios and the net developable area identified in the study;
- undertake a market assessment of the area’s development potential;
- undertake an initial assessment of the full potential benefit of such development;
- identify ecological mitigation, flood defence, accessibility and other infrastructure locations and costs, using and the potential developable area each would ‘unlock’;
- assess the most economic scale and scope of development and a phased implementation plan;
- draft a cost/benefit analysis derived from the above; and
- develop a recommendation as to the scale and scope of development based on the above factors.

1.7.8 The bulk of the work was intended to be desk-based, secondary research. The brief noted that much of this work had already been undertaken but required a desktop review to identify interrelationships and timing and phasing issues and any critical gaps in information.

1.7.9 The study has been undertaken in parallel with separate technical reports being prepared by other consultants about the area’s flood risk and ecology (see sections 1.8 and 1.9 below). We have relied on the information within these emerging reports in undertaking this study.

1.8 Strategic Flood Risk Assessment – Level 2 (SFRA 2)

1.8.1 A Strategic Flood Risk Assessment – Level 2 (SFRA 2) was commissioned by Bristol City and South Gloucestershire Councils and the Lower Severn Drainage Board and was published by the Councils at the end of March 2011 (see: [http://www.southglos.gov.uk/Resources/Publications/PTE/11/0200/PTE-11-0072](http://www.southglos.gov.uk/Resources/Publications/PTE/11/0200/PTE-11-0072) or [http://www.bristol.gov.uk/page/strategic-flood-risk-assessment-sfra](http://www.bristol.gov.uk/page/strategic-flood-risk-assessment-sfra)). The SFRA 2 comprehensively sets out the flood risk issues affecting the study area and options for mitigating that risk.

1.9 Severnside and Avonmouth Wetland Habitat Project

1.9.1 Cresswell Associates (Hyder) was commissioned by Bristol City and South Gloucestershire Councils and Natural England to prepare a report about the impact of planned development in the study area on its ecology – the Severnside and Avonmouth Wetland Habitat Project Stage 2: Review of Consent at Severnside and Assessment of Avonmouth Development Proposals, but this report has not yet been published.

1.9.2 We have however taken into account the findings of a draft version of the Report (issued in November 2010) and a more recent draft summary of this study (issued in December 2011). The draft Report identifies the potential impacts of planned developments in the area on its ecology and considers options for mitigating those impacts. In particular, it recommends that the feasibility of
habitat creation/enhancement works at the potential mitigation sites should be subject to further investigation.

1.10 Methodology

1.10.1 Our broad methodology for undertaking this study was to:

- review the area’s planning history and current and emerging planning policies;
- assess the extent to which current planning policies facilitate development within the study area;
- examine existing data sources to identify constraints to development within the study area;
- map those constraints to identify potential sites to accommodate new development;
- identify opportunities and options to overcome the constraints;
- identify opportunities for economic development within the area;
- review the benefits and costs of the options; and
- examine opportunities for securing funding for the options and the next steps to bringing them forward.

1.11 Structure of Report

1.11.1 This report is structured to:

- review the area’s recent history of development;
- examine current and emerging development plan policies;
- identify the nature and scale of the challenges facing the area; and
- identify opportunities to address those challenges by developing infrastructure or implementing mitigation schemes.

1.11.2 A separate report (Avonmouth/Severnside Outline Development Strategy) examines opportunities for funding the infrastructure and mitigation that will be required to bring forward the area’s continuing economic development.

1.11.3 The need to address the challenges is extremely important not only to potentially release additional land for development to promote the area’s economic potential, but also to ensure that both existing and current planned development within the study area is sustainable to 2050 and beyond.

1.12 Costs

1.12.1 The cost estimates in this report are based on a number of assumptions, some of which are outlined in this report. At this stage, the cost estimates are not based on detailed proposals for the identified infrastructure/mitigation measures. Further analysis of the costs of the infrastructure will be required as detailed proposals for infrastructure and mitigation measures are developed and options are tested by the Councils and their strategic partners moving forwards.

1.12.2 It should also be noted that the costs focus on the potential initial capital costs of developing the infrastructure and do not take into account future maintenance, repair or replacement costs.
1.12.3 This report focuses on the options that are set out in existing studies, but there may be other lower
(or higher) cost options that may be capable of addressing the infrastructure requirements in the
area.

1.13 Land Ownership

1.13.1 The land within the study area is in multiple ownerships. However, the plan at Appendix 3 shows
that much of the area is within the ownership of Bristol City Council, Bristol Port and Aviva (although
it is understood that this land is now owned by Severnside Distribution Limited). In particular, much
of the central, undeveloped part of the study area that is within agricultural use is within Bristol City
Council’s ownership.

1.13.2 The diverse land ownership of the study area means that any co-ordinated strategy for the area’s
future development will require the engagement and co-operation of many of these land owners.
This is recognised in particular in South Gloucestershire Council’s Core Strategy in the context of the
57/58 permission.

1.13.3 There is a significant risk that land ownership issues will challenge a comprehensive strategy for the
area’s development. The Councils (and other agencies with such powers) may therefore need to
consider the opportunity to use compulsory purchase powers to implement a strategy for the area’s
comprehensive development where infrastructure/mitigation works are required on land outside
their ownership, or the benefits of a co-ordinated approach are at risk of not being delivered.

1.14 Consultation

1.14.1 This report and the associated technical appendices have been prepared following consultation on a
number of the technical issues that have been analysed in our work.

Workshop

1.14.2 A workshop attended by representatives from each Council, the Highways Agency and Natural
England was held in January 2011. A summary of some of the key points arising from that workshop
is attached at Appendix 4.

Environment Agency

1.14.3 Separate meetings have been held with representatives from the Environment Agency. Notes of
those meetings and correspondence with the Environment Agency are attached at Appendix 5.

HSE

1.14.4 An informal discussion was held with a representative from the HSE to establish the implications of
the COMAH consultation zones and the implications for the area’s future development. The
discussion highlighted the HSE’s use of the PADHI, their land use planning methodology. This
methodology has been used to assess the possibility of development in proximity to hazardous
installations within the study area.
1.14.5 A separate meeting was also held with representatives from Bristol Port in February 2011. The purpose of this meeting was to seek further information about the Port’s proposed Deep Sea Container Terminal that now has the necessary parliamentary approval to proceed. The Port’s representative indicated at that time that it is intending to complete the DSTC in 2015.

1.15 **Technical Reports**

1.15.1 This report is accompanied by a separate technical study about flood risk (see Appendix 6) that has been used to inform the contents of this report. We have not summarised the findings in this report, but have drawn on its findings and the background research that informed it.

1.16 **District Heating**

1.16.1 The Project Brief also required an investigation into the feasibility of a district heating system in the study area. A separate technical report to address this section of the brief is attached at Appendix 7 and a summary response to the requirements of the brief is set out in section 13.0 of this report.
2.0 Planning History

2.1.1 The study area has developed for port, infrastructure, industrial, warehousing, waste disposal and processing and other uses over the last century, with most development taking place beyond the port in the latter part of the twentieth and early twenty first century.

2.1.2 The plan and schedule at Appendix 8 illustrates the sites that benefit from extant planning permissions and sites where applications have been submitted but (as of 28th February 2011) had not been determined by the Councils. The plan also shows the location of the Port’s Deep Sea Container Terminal consent and the extent of the 57/58 planning permissions.

2.1.3 The planning history illustrates the extensive economic development that has been granted planning permission over this period. It includes the development of previously developed and green field land.

2.2 Avonmouth

2.2.1 Over the last 50 years, there has been a gradual shift in the area from heavy industry towards distribution and warehousing uses. More recently, there has been an increase in demand for low carbon energy generating and waste management facilities in the area. In the Avonmouth area around junction 18 of the M5, there has been a gradual introduction of various quasi-retail uses and retail trade operations and we anticipate that the pressure for such non traditional employment uses is likely to continue in that part of the area.

2.3 Severnside – the 1957/58 Permissions

2.3.1 The planning history of Severnside is dominated by outline planning permissions granted to ICI in 1957 and 1958 for about 750 hectares of land and an additional 450 hectares extending into the Severn Estuary. The extent of the land covered by the 57/58 permissions is shown in the plan at Appendix 8.

2.3.2 The permissions have been implemented and provide “in principle” consents for a wide range of land uses including:

- factories for the production of chemical and allied products;
- offices;
- warehouses and stores;
- canteens, clubs, hostels, training establishments, amenity and welfare buildings;
- sports pavilion and sports playing fields; and
- the construction of any buildings, structures, erections or engineering works expedient for, or ancillary to, the construction and operation of the factory (for the production of chemical and allied products).

2.3.3 The original intention of these proposals was to enable the development of a multi functional, self contained industrial complex to be operated by ICI. However a substantial proportion of the land covered by the original planning permissions has subsequently been sold and some has already
been developed, or is in the process of being developed, for predominantly warehouse and distribution uses.

2.3.4 The scope of the permissions has been the subject of challenges but it has now been established that they are valid and capable of ongoing implementation. The impact of these permissions is that the land covered by them may be developed for the variety of uses outlined above without the need for further planning permissions. This limits the Councils’ ability to secure mitigation (including, for example, s106 contributions and the CIL) for the impacts of the development on this area through the planning system.

2.3.5 At present, the area covered by the 57/58 permissions is continuing to be developed mainly for warehouse and distribution uses.

2.3.6 For the purposes of this study, we have assumed that the 57/58 permissions will only be implemented insofar as they affect the area to the east of the existing flood defences and that they will not be implemented within the estuarine environment (see section 3.1.14 below).

2.4 Western Approach Phase 1 (WAP 1) Development

2.4.1 Notwithstanding the existence of the 57 permission, prior to the testing of this in the courts, the landowner (ICI) of a substantial part of the area covered by these permissions (about 90ha) submitted an outline planning application to develop the WAP 1 as a distribution park for B8 uses under the reference P94/0400/8. It was granted permission subject to a s106 agreement (see Appendix 9) that:

- includes areas for the provision of ecological mitigation;
- provides an option (until 2016) for the Council to complete the spine road and introduce a dual carriageway and LRT line through the site; and
- includes the “surrender” of the parts of the 57 permission that are to the west and north west of the A403 and within the area shown as an “estuary buffer zone” on the plan extract below:
2.4.2 The plans incorporated in the s106 agreement (see extract below) included options for a single M49 junction and separate north and south bound junctions and identified a potential road link to Easter Compton:
2.4.3 The WAP 1 s106 agreement also includes the provision of a 38 ha area as a “nature sanctuary” within the area edged green (with a core area of 28 ha hatched green) on the plan extract below (and on the plans at Appendix 10):

2.4.4 Subsequent reserved matters applications include details of the “spine road” that runs through the WAP 1 site. The road has been designed for dualling at a later date. It therefore occupies a corridor with a width of about 100 metres (to allow for landscaping, drainage and carriageways).
This permission was linked to work at that time by the former Avon County, Bristol and Northavon Councils who published an Interim Draft Avonmouth/Severnside Development Strategy for “informal consultation” in 1994. The aim of the Strategy was to “facilitate the co-ordinated development of Avonmouth/Severnside and to safeguard and enhance the environment”. The purposes of the Strategy included the provision of a “coherent framework for the phasing of development over the next 20 to 30 years, building on the economic and environmental opportunities of the area” and to “establish, in general, requirements and responsibilities for infrastructure provision and site planning”.

At the time that the Strategy was in preparation, it was anticipated that, in addition to the development of the land covered by the 57/58 permissions coming forward, substantial additional areas of land would be brought forward.

For the purposes of this study, we have assumed that the WAP 1 permission has been implemented and that the provisions of the s106 agreement remain in force. In particular, we have assumed that the s106 agreement associated with that permission:

- removes the opportunity for the development of land within the estuary itself under the terms of the 57/58 permissions;
- restricts development within the 28ha core area of the ecological refuge area; and
- requires 38ha of ecological mitigation (including the 28ha core area) within the area shown on the plan at paragraph 2.4.3 and plans at Appendix 10 as part of the development and that this will be brought forward within the next 5 years.

The effect of the planning permission and s106 agreement is therefore to significantly reduce the extent of the area available for B1, B2 and B8 development under the 57/58 permissions (see plan at Appendix 8 that shows the extent of the 57/58 permission as it originally extended into the estuary).
3.0 Planning Policy Context

3.1 The Development Plan

3.1.1 Decisions on planning applications should be made in accordance with the development plan unless material considerations indicate otherwise. The development plans for the study area therefore set the scene for its future economic development in the short term.

3.1.2 In the longer term (i.e. to 2050), if the Councils’ are to achieve their vision that is set out in the Brief for this project, current development plan policies will need to be revised to facilitate further development.

3.1.3 At present, the development plans for the study area comprise the:

- Regional Planning Guidance 10 (the Regional Strategy for the area although the government has indicated its intention to abolish such Strategies) at [http://www.swcouncils.gov.uk/media/SWRA/Transport/RPG10Fulltext.pdf](http://www.swcouncils.gov.uk/media/SWRA/Transport/RPG10Fulltext.pdf);
- “saved” policies in the Joint Replacement Structure Plan at [http://www.westofengland.org/media/60848/adoptcomp.pdf](http://www.westofengland.org/media/60848/adoptcomp.pdf);
- Bristol Core Strategy ([http://www.bristol.gov.uk/page/planning-core-strategy](http://www.bristol.gov.uk/page/planning-core-strategy)); and

3.1.4 Furthermore, although South Gloucestershire Council’s Core Strategy ([http://www.southglos.gov.uk/NR/exeres/99affbab-2714-4578-9d10-886983548a6c](http://www.southglos.gov.uk/NR/exeres/99affbab-2714-4578-9d10-886983548a6c)) has not yet been adopted, it does illustrate the Council’s current intentions in respect of the study area.

3.2 Policy Changes

3.2.1 The planning policy background to this study has changed significantly since it was commissioned. In particular:

- the government has re-affirmed its intentions to abolish regional strategies (including Regional Planning Guidance 10 (RPG10));
- the government has published a Draft National Planning Policy Framework that will lead to the replacement of current Planning Policy Guidance and Statements;
- the Councils, with others in the former West of England area, have adopted a Joint Waste Core Strategy (JWCS) that allocates 7 previously developed sites for residual waste treatment facilities within the study area;
Bristol City Council has adopted its Core Strategy that sets out its vision for the future development of Avonmouth which states that: “Avonmouth will maintain its status as a regionally important industrial and warehousing business location”; and

South Gloucestershire has submitted its Core Strategy for independent examination (although progress on the examination has been delayed).

### 3.3 Implications of Change

3.3.1 The key implication of the ongoing changes to policy and funding options mean that this report must be understood in the context of its publication date. After this date, further policy, legislative and evidence changes could have significant implications for the “right” approach to pursuing both Council’s economic and other development objectives for the study area.

3.3.2 For the purposes of this study, we have assumed that the adopted Bristol and emerging South Gloucestershire Core Strategy policies that will govern development proposals in the study area will remain in place until at least 2016. Substantial revisions to the Core Strategies are unlikely to be adopted in advance of 2016.

3.3.3 The following sections examine the most important development plan documents in the study area in more detail. In particular, we have focused on the Bristol and South Gloucestershire Core Strategies that set out each Council’s current (or emerging) planning policies for the area’s development.

3.3.4 Although the brief for this study requires that we look forward to 2050, current development plan policies for the study area are an important starting point for reviewing the area’s development potential.

### 3.4 RPG10

3.4.1 RPG10 is the Regional Strategy for the study area. However, the government has confirmed its intention to abolish Regional Strategies and therefore little weight is given to RPG10 (and the previously issued draft Regional Strategy) in this study.

### 3.5 Joint Waste Core Strategy (JWSC)

3.5.1 The JWCS covers the West of England area and includes the study area. The Strategy allocates 7 sites for development within the study area for residual waste treatment facilities and these are shown on the plan at Appendix 10. The combined area of the allocated sites is more than 100ha. The majority of the allocated sites comprise previously developed land.

3.5.2 The JWCS highlights the need for detailed proposals for the development of each site to incorporate flood and ecology mitigation measures.
3.6 Joint Replacement Structure Plan

3.6.1 The Joint Replacement Structure Plan for the area was adopted in 2002. Although the Structure Plan policies were only intended to run until the end of March 2011, they remain part of the statutory development plan for the area.

3.6.2 The Structure Plan noted that:

“realising the full economic potential of the area will require Bristol and South Gloucestershire, in conjunction with other agencies, to prepare a joint strategy for the comprehensive development of the whole area which clearly links land use developments to an agreed transport infrastructure and its funding.”

3.6.3 The Structure Plan focuses on the transport and other environmental constraints in the study area and notes that:

- the area lacks the public transport infrastructure which could prevent congestion arising, and studies suggest that there would be substantial and probably prohibitive costs in providing and running such a system;
- agreement on the funding of a new M49 junction and improvements to the local road network, particularly a realigned A403, will be essential prerequisites to realising development potential in the study area;
- the area’s development could impact on nature conservation interest; and
- flood risk needs to be addressed.

3.6.4 Policy 14 in the Structure Plan envisaged that development plan policies would, inter alia, make provision for:

- the construction of the M49 Intermediate Junction;
- a Spine Road linked to the M49 junction between Avonmouth and Severn Beach and forming a realigned A403;
- the Kings Weston Lane links; and
- other necessary local improvements;

through development funding.

3.6.5 The Joint Replacement Structure Plan acknowledges the role of land in the study area in providing development opportunities for economic expansion in the short and long term.
3.7 South Gloucestershire Local Plan

3.7.1 South Gloucestershire Council’s adopted Local Plan policies sought to realise Severnside’s “economic development potential”. The Plan recognises the area as a key strategic location of regional importance for a range of employment uses which require extensive areas of land and good links to the motorways, the rail network and dock facilities at Avonmouth.

3.7.2 Local Plan policies acknowledge the extant 57/58 permission and seek as far as possible within the limits imposed by those permissions to:
- safeguard sensitive areas of nature conservation importance in the estuary;
- protect the amenities of local communities; and
- control the phasing of development and require the introduction of public transport measures to ensure that traffic generated by development does not significantly exceed the capacity of the existing and improved road network and that alternatives to the private car are available.

3.7.3 In respect of transport in the study area, the Local Plan asserted that:

*Current analysis indicates that an acceptable and comprehensive development at Severnside/Avonmouth will require three major road schemes, together with local road improvements.*

3.7.4 “Saved” Local Plan Policy E2 states that the requirements include:
- an M49 junction;
- a link road to the M49 junction;
- a spine road designed to link through the area to the south;
- other necessary local road improvements; and
- public transport improvements.

3.7.5 The Local Plan notes that the principle of the new M49 junction serving the large scale employment development at Severnside and Avonmouth was agreed at the parliamentary hearing into the Severn Bridges Bill and was reflected in a government publication in 1998 (although it should be noted that since that time, further development has taken place within the study area and other transport infrastructure improvements have been brought forward and are planned outside the study area).

3.7.6 A diagrammatic plan of the proposed transport improvements was included at Figure 7.8 in the Local Plan (see below). It shows a potential location for the M49 junction substantially further to the south than was indicated in the s106 agreement attached to the WAP 1 planning permission (see 3.1.17 above).
3.7.7 The Local Plan seeks to restrict the further development of the area beyond that in the 57/58 permissions as set out in “saved” policy E4 until a "comprehensive development strategy" is prepared during the Plan period. However, “saved” policy E2 does identify the majority of the land to the west of the M49 as being within an area where the Council is committed to realising its long term employment potential.

3.7.8 The areas covered by “saved” policies E2 and E4 are shown on the Proposals Map at: [http://hosted.southglos.gov.uk/localplan/7side%20set/SEVERNSIDE%20inset.pdf](http://hosted.southglos.gov.uk/localplan/7side%20set/SEVERNSIDE%20inset.pdf). These areas include most of the study area that lies within the South Gloucestershire.

3.7.9 It is anticipated that “saved” Policies E2 and E4 will be superseded by the Core Strategy Policies in due course.
3.8 South Gloucestershire Core Strategy

3.8.1 South Gloucestershire Council’s Core Strategy has been submitted to the Secretary of State for examination. The Strategy notes that although the area has extant planning permissions there are a number of constraints which affect its development potential, including:

- national and international nature conservation designations relating to the Severn Estuary.
- the risk of flooding from the River Severn due to breaching or overtopping of the existing flood defences, coupled with a rising tide level, as well as groundwater flooding;
- the limited capacity of the existing highway network and infrastructure in the area; and
- high archaeological interest in the Severn Levels.

3.8.2 South Gloucestershire Council is concerned that continuing development of individual land parcels outside of an overall agreed strategy or framework plan, without protection and mitigation of key interests, and without a degree of coordination, could cumulatively impact on addressing the key constraints identified above and in particular:

- could have a significant effect on the ecology and conservation assets of the Severn Estuary and cause significant and irreparable damage to estuarine and floodplain ecology and associated international designations;
- reduce flooding capacity without improvement to flood defences and increase the risk of flooding to third parties;
- damage the network of rhynes which provide the local drainage network and which are of ecological interest;
- worsen traffic congestion on the local road and motorway network; and
- result in the irretrievable loss of valuable archaeological assets.

3.8.3 The Council’s overall desire is therefore to develop, in partnership with others, a Strategic Framework Plan for the area’s development.

3.8.4 The emerging Core Strategy encourages joint working and cooperation between South Gloucestershire Council and landowners to overcome the constraints in and around the area. The Sustainability Appraisal (see: http://www.southglos.gov.uk/NR/rdonlyres/EA2CB997-6D66-4472-8A71-08B24CCAC008/0/PTE100060.pdf) notes that if these constraints are not overcome further employment development in the area could have negative sustainability impacts.

3.8.5 The SA notes that without the successful implementation of mitigation strategies outlined in the supporting text to the emerging Core Strategy policy about Severnside’s future development, the implementation of the extant consents would have severe negative implications for the sustainability of the area, in terms of:

- the impact on biodiversity and natural habitat, and the associated national and international designations;
- the impact on both local highways network and strategic road infrastructure;
• the impact on and permanent loss of potential archaeology; and
• flood risk, which will worsen as climate change increases throughout the plan period and beyond.

3.8.6 The Core Strategy’s conclusions in relation to the land covered by the 57/58 permissions apply to the development potential of other land within South Gloucestershire Council’s area that is not covered by those permissions.

3.8.7 Draft Policy CS11 seeks to safeguard the land covered by the 57/58 permissions for economic development. Draft Policy CS35 will supersede “saved” Local Plan policies E2 and E4 insofar as they apply to the study area. It is intended that Policy CS35 will however apply to the same area as that covered by “saved” Policy E2 (see plan below in paragraph 4.8.13).

3.8.8 Paragraph 4.26 of the draft Core Strategy notes that the continued development of the area will be primarily for warehousing and distribution uses.

3.8.9 Draft Policy CS5 seeks to realise the area’s economic potential, subject to the resolution of the various environmental constraints.

3.8.10 Policy CS7 about Strategic Transport Infrastructure does not identify proposals for the delivery of a new junction on the M49 in the period to 2026, although paragraph 7.12 notes that:

The Council will also work to continue to identify funding and lobby central government and the Highways Agency to deliver a junction on the M49 to enable further employment development at Severnside and Avonmouth.

3.8.11 The development of a new M49 junction therefore continues to be a pre-requisite to further development in the study area beyond that which already benefits from extant planning permissions.

3.8.12 The study area is located within the Coastal Zone as defined on the Proposals Map. Draft Policy CS9 states that new development should “avoid the undeveloped Coastal Zone” and states that:

“such development that requires a coastal location will be directed to the developed areas of the Zone (these are the areas within the ….. Severnside employment area …..), subject to satisfying the requirements of the Exception Test as set out in PPS25, the legal provisions of the Habitats Regulations 1994 and meeting the conservation objectives of the Severn Estuary SPA/SAC/Ramsar.”

3.8.13 The separate draft Policy CS35 sets out the proposed approach to that part of the study area’s development that falls within South Gloucestershire and acknowledges the Council’s role in taking forward mitigation strategies for the area.

3.8.14 The draft policy sets out the Council’s:

“intention is to seek co-operation from all landowners through a strategic framework plan for the whole area that has been agreed with the Council, together with a planning performance or co-operation agreement.”
3.8.15 The area covered by the draft policy reflects that covered by current “saved” Local Plan Policy E2. It therefore covers land beyond that covered by the 57/58 permissions and includes substantial areas of undeveloped green field land (see plan below).

Extract from South Gloucestershire Core Strategy

Proposed Change:

1. **New Figure, showing the extent of the Severnside area.**
However, the draft Policy states that:

*Land at Severnside will be safeguarded and developed for distribution and other extensive employment uses broadly in line with the extant planning permissions dating from 1957 & and 1958.*

and it therefore appears that the intention is that the land safeguarded for employment development is more specifically restricted to that covered by the 57/58 permissions, although the policy itself covers a much wider area.

The draft Core Strategy also notes that the review of the 57/58 permissions being undertaken by Cresswell Associates is underway in accordance with the requirements of the Habitat Regulations.

On transport matters, the Core Strategy also notes at paragraph 17.16 that:

*The Highways Agency Avonmouth/Severnside traffic model predicts the traffic impact for development scenarios without a new M49 junction in place. This clearly demonstrates that the limited capacity of the existing local road network will be overwhelmed by traffic demand arising from new development and there will be traffic congestion both within the Avonmouth/Severnside area and on the road links leading up to it. This congestion will deter new businesses from setting up in the area, unless capacity is increased and access to major routes improved. There will also be adverse environmental impacts arising from the increase in traffic loadings.*

The Council’s desire is therefore to see the delivery of a new M49 junction as part of the area’s development. The Core Strategy does however acknowledge that “employee related trips are more likely to use the local road network” and it therefore also supports a “green travel” approach to employee travel to and from the area and significant improvements to associated bus and rail links.

We have not, as part of our work, examined the earlier evidence in respect of transport modelling within the study area, but have relied upon the broad conclusions that have been brought forward from the adoption of the Structure Plan in 2002 to the emerging Core Strategy i.e. that there is a need for a new M49 junction and other transport improvements to relieve the potential for congestion that could deter economic development in the area.

**3.9 Bristol Local Plan**

Most of the specific Local Plan policies that governed development proposals within the Avonmouth area have not been saved and have been superseded by Core Strategy Policy BCS4 (see section 3.10). The recently adopted Core Strategy for Bristol sets out a more restrictive approach to the development of the Avonmouth area than was envisaged in the Local Plan.

The Local Plan originally envisaged that a Key Regeneration Area be allocated for employment uses to the north of the existing railway line through the area. The allocated area (hatched red in the plan below) principally comprised green field land immediately to the north and south of the railway line through the Avonmouth area. Although much of the land to the south of the railway line has
been developed for warehousing and distribution uses over the last 15 years, the majority of the allocated land to the north remains in agricultural use.

**Extract from Bristol Local Plan Proposals Map**

3.9.3 This Council's revised approach in its adopted Core Strategy is taken in recognition of the challenges that need to be addressed within the study area, particularly in relation to the development of green field land.

**M49 Junction**

3.9.4 In a similar manner to the South Gloucestershire Local Plan, the Bristol Local Plan also identified a requirement for a realigned A403 and new M49 junction. The Plan envisaged that the A403 be diverted to run through the Key Regeneration Area to act as a spine road for that area's development and to link to a new M49 junction. At that time, the Plan also referred to the possibility of a new link between the A403 and junction 17 of the M5 within South Gloucestershire.
Extract from Bristol Local Plan

Figure 12.2: Illustrative road network and split junction.

1. Central Intermediate Junction
2. Diversion of A403 Providing New Spine Road
3. Southern Links to M5 J18
4. Northern Links within Avonmouth / Severnside
3.9.5 The indicative plans in both the Bristol and South Gloucestershire Local Plan identified proposals for a new M49 junction in a central location within the study area, just to the north of the existing LNG plant (see sections 3.7.6 and 3.9.4 below).

3.10 **Bristol Core Strategy**

3.10.1 Bristol City Council adopted its Core Strategy in 2011 and the policies in it must be read alongside other development plan policies. The Strategy deletes land that was previously allocated for “regeneration” development in the Avonmouth area from the Local Plan Proposals Map. The Vision for the area’s development is set out in paragraph 2.7.4 above. The broad approach is to balance support for the area’s economic importance as the City’s largest industrial area with the protection of its environmental assets.

3.10.2 Core Strategy policy BCS4 deals specifically with the Avonmouth area and seeks to particularly encourage “proposals for port-related activities, manufacturing industry, logistics/distribution, waste management and other environmental technology related industries”. The policy also acknowledges that there may be opportunities for the development of “energy from waste facilities, biomass energy and further large scale wind turbines”.

3.10.3 The supporting text to the policy in the adopted Strategy states that it “does not promote new allocations for employment development on green field land.” It also notes that development within the area should only comprise industrial and warehousing and sui generis uses of a similar nature.

3.10.4 Paragraph 4.6.16 in support of Policy BCS16 explicitly states that:

> It is not proposed to designate green field sites for industrial and warehousing use where that land is at risk of flooding and does not already benefit from planning permission.

3.10.5 This approach is carried through to the Council’s emerging Site Allocations DPD (see section 4.11 of this report).

3.10.6 The Core Strategy notes the need to work with other partners in the area and, in particular Natural England, the Environment Agency and neighbouring Council’s (including South Gloucestershire Council) to “explore potential habitat creation” in the area. This commitment is being taken forward via the study commissioned from Cresswell Associates (see section 1.9 above).

3.11 **Site Allocations Development Plan Documents (DPD)**

3.11.1 Neither Council has published its Site Allocations DPD. However, Bristol City Council has consulted about preliminary proposals for the Avonmouth area in 2010 (see documents at: [http://www.bristol.gov.uk/page/site-allocations-and-development-management-document](http://www.bristol.gov.uk/page/site-allocations-and-development-management-document)).

3.11.2 Bristol City Council has indicated that its DPD will identify the Principal Industrial and Warehousing Areas (PIWA) as explained in the delivery section of Core Strategy Policy BCS8. The PIWA will include locations which have been developed for industry and warehousing since the Employment Land Study surveys were undertaken and any green field sites with unimplemented planning permissions.
3.11.3 The DPD will also identify important freight and passenger rail facilities and infrastructure in Avonmouth for safeguarding. The DPD is expected to reflect the Core Strategy’s broad approach of not promoting employment development on green field land at Avonmouth.

3.12 **Community Infrastructure Levy (CIL)**

3.12.1 Bristol City Council has published a draft charging schedule for the CIL in November 2011. It anticipates a nil charge for economic development and it is therefore likely that such development in the Avonmouth/Severnside area will not be liable for CIL. Bristol City Council will however be able to consider whether to prioritise the spending of CIL collected from other development on the strategic infrastructure required for this study area.

3.13 **Bristol Employment Land Review**

3.13.1 The Council’s Employment Land Review 2009 ([http://www.bristol.gov.uk/page/land-use-development-and-planning-policy-research#jump-link-5](http://www.bristol.gov.uk/page/land-use-development-and-planning-policy-research#jump-link-5)) notes about the Avonmouth area that:

> Alder King have commented that much of the land remaining in Avonmouth is being taken-up by a particular type of operation; namely, for large format distribution premises. They also highlight the role that it can play in supporting the operations of the Port of Bristol.

... 

> Furthermore, Alder King and other industrial property agents have reported that Avonmouth might not be suitable for all new industrial and warehousing development. This is because some industrial and warehousing operations require significant staff numbers to carry out their operations. Avonmouth has a limited local labour supply. As a consequence, there is a perception that many existing companies in Bristol would prefer the choice of sites in parts of the city ideally closer to their current location and its labour force.

... 

> During the consultation process the Bristol Industrial Agents Society (IAS) – of which Alder King is part – concurred with the City Council’s view that there was a need to provide additional industrial and warehousing land to meet demand in the city. They also identified a developing need to provide more at Avonmouth, that was driven by the demands of an expanding and developing retail sector and changes in distribution patterns and practices. They noted that the growth of the Port of Bristol was likely to add to this demand.

3.13.2 The study concludes that:

> Although it would be inappropriate to add to existing risks by allowing additional development in the Avonmouth industrial area, there would be unacceptable economic consequences if the process of renewal was to be prevented, undermining confidence in its future. Any loss of PIWA land here could not be replaced elsewhere within Bristol. In view of its vital employment role and the key infrastructure located in the Avonmouth area – motorways, rail links, port, power station, etc. – it is essential that regeneration of the existing developed area is sustained.
3.13.3 The existing Principal Industrial and Warehousing Areas (PIWA) of Avonmouth were reported as occupying approximately 620ha.

### 3.14 South Gloucestershire Employment Land Review

3.14.1 The Council’s Employment Land Review Stage 3 June 2010 ([http://www.southglos.gov.uk/NR/rdonlyres/0B4D8151-44CF-4783-B541-A19AE18915B3/0/PTE100127.pdf](http://www.southglos.gov.uk/NR/rdonlyres/0B4D8151-44CF-4783-B541-A19AE18915B3/0/PTE100127.pdf)) notes demand for accommodation for "new technologies" at Emersons Green and manufacturing and distribution facilities at Severnside. In particular, it notes that, at Severnside, there is active interest in developing the area – principally for Distribution uses. The Review also notes that waste management and energy related developments have difficulty in finding appropriate sites, apart from Severnside, and suggest that planning policies should plan to accommodate such uses in the area.

3.14.2 The Review concludes in relation to Severnside that, inter alia, the area is suited to:

> "low intensity employment related uses including warehousing, recycling and energy generation. Waste Management and energy related developments have difficulty in finding appropriate sites, apart from at Severnside, so policy should allow for this in a controlled way."

3.14.3 The Review does however also note that the take up of land covered by the 57/58 permission will be "largely driven by market forces."

### 3.15 South Gloucestershire Local Economic Assessment (LEA)

3.15.1 The LEA notes that:

> The Severnside Strategic Employment area is located next to the River Severn to the west of the M49 and the urban area of Bristol. Due to planning permissions granted in 1957/58 covering approximately 650 hectares, the area has been recognised for some years as a potential major employment location. Regional and local planning policy continues to support its development, while recognising the significant constraints that affect the area by way of flood risk, highway infrastructure, ecology and archaeology.

### 3.16 Conclusions

3.16.1 Each Council’s Local Plan policies have been broadly supportive of further economic development within the study area, subject to proposals addressing the identified constraints. The adopted Bristol Core Strategy and emerging South Gloucestershire Strategy both acknowledge, to a greater extent than earlier policies, the environmental constraints to further development in the study area.

3.16.2 This study does however look beyond the Core Strategy period of 2026 to 2050 and the opportunities for further development within that period. It therefore seeks to identify opportunities to address the constraints identified in current and emerging development plan documents.

3.16.3 The desire to see the study area reach its full potential and bring forward significant areas of additional green field land for development before 2026 within the Bristol area may need to be tested through the Site Allocations and Development Management DPD in respect of the Avonmouth area and review of the Core Strategy, or by way of planning application..
4.0 Control of Major Accident Hazards (COMAH)

4.1 Context

4.1.1 Sites that use and store large quantities of hazardous substances pose risks to the surrounding population. These risks are regulated and managed in a number of ways, mainly through compliance with the COMAH Regulations, but also by controls on land use planning.

4.1.2 COMAH regulations and related guidance aim to prevent major accidents involving dangerous substances and to limit the consequences to people and the environment of any that do occur. Local planning authorities are required to consult HSE on certain proposed developments in the vicinity of major hazard establishments and to take into account advice from HSE when making planning decisions.

4.1.3 The study area includes a number of industrial and infrastructure installations that use and/or store large quantities of hazardous substances. The use of these is regulated under the Control of Major Accident Hazards Regulations 1999 and the Amendment Regulations 2005, commonly referred to as COMAH.

4.1.4 Each installation within the study area is shown on the plan at Appendix 11. The plan and other plans at Appendix 11 also show the HSE designated consultation areas around these installations. Within these consultation zones, the Councils should consult the HSE about development proposals that are likely to lead to an increase in population within those areas.

4.1.5 When the HSE is consulted about such development, it will either advise against the proposed development or note that it does not advise against it. The HSE’s role in the land use planning system is advisory. It has no power to refuse consent or a planning application. It is the responsibility of the HSE or LPA to make the decision, weighing local needs and benefits and other planning considerations alongside HSE advice.

4.1.6 Councils may be minded to grant permission (or allocate land for development) against HSE advice. The HSE will not pursue the matter further as long as it is satisfied that the Council understands and has considered the reasons for their advice. However they do have an option, if they believe for example that the risks are sufficiently high, to request that decisions are 'called in' for consideration by the Secretary of State.

4.1.7 The HSE responds to consultations about new development proposals using its recently developed PADHI (Planning Advice for Developments near Hazardous Installations) methodology:


4.1.8 The HSE guidance is based on the consultation zone in which development is proposed and the "sensitivity" of that development. The HSE "Advises Against Development" of "workplaces (predominantly non-retail) providing for 100 or more occupants in any building" in Inner Consultation Zones.
4.2 Implications for the Study Area

4.2.1 Although some small scale employment development on green field land and the development of previously developed has been permitted within the Inner Consultation Zones of hazardous installations within the study area, for the purposes of this study, we have assumed that additional employment development should normally be avoided within such Zones.

4.2.2 However, the restriction on employment development within the HSE Inner Consultation Zones does not apply to the development of the 57/58 permission because that permission was granted prior to the introduction of the HSE guidance. The presence of these Zones may however affect investment within the areas covered by them in the future, but that does not appear to be the case at present.

4.2.3 The situation in relation to previously developed land is less straightforward. Each site is different, but the general approach of the HSE will be to advise against development that could increase the risks within such areas i.e. that could result in significant numbers of additional people being employed within such areas.

4.2.4 However, for the purposes of this study, we have assumed that, even if the HSE were to advise against the development of previously developed land within the designated Inner Consultation Zones, other material planning considerations are likely to weigh in favour of such development. We have therefore assumed that hazardous installations would not unduly restrict the redevelopment of previously developed land for employment purposes. This assumption would need to be reviewed in more site and hazardous installation specific detail in consultation with the HSE.

4.2.5 It should also be noted that it *may* be possible to develop some low employment generating uses within the Inner Consultation Zones around hazardous installations (for example, open storage uses). This approach could enable the redevelopment of existing sites in use for low employment generating uses, such as open storage, for more intensive employment uses. For example, the Co-op is developing its new 40,000 square metre distribution warehouse on land previously used by Honda for open storage purposes in the Avonmouth area.

4.3 Transport Infrastructure

4.3.1 The indicative location of the new M49 junction that is shown in both Councils’ Local Plans is within an HSE Inner Consultation Zone. The HSE would normally object to the development of new motorway infrastructure within such Zones. Proposals for the new M49 junction will need to be the subject of consultation with the HSE, but it is likely that they would advise against such a development. It is therefore likely that a new M49 junction would need to be located outside the HSE’s Inner Consultation Zones (for example, in the location illustrated in the s106 agreement attached to the WAP 1 permission (see section 2.4.2)).

4.4 National Grid’s Liquified Natural Gas (LNG) Storage Facility at Avonmouth

4.4.1 National Grid’s LNG facility at Avonmouth is located between the developed Severnside and Avonmouth areas in proximity to the M49 to the east (see H0584 on the plan at Appendix11). It is one of three such facilities in the UK. It has the largest HSE designated Inner Consultation Zone within the study area and, because of its location, would restrict employment development of some
of the green field land within central part of the study area. We have therefore investigated the likelihood of this facility closing during the period to 2050.

4.4.2 Although we have not consulted the operator of the facility about its intentions, the OFGEM report at:

states that:

Avonmouth is the newest of the three sites, and its facilities are in comparatively good condition. NG LNG consider that it has a viable future supplying both commercial and regulated services, and have submitted plans for refurbishment to prolong the site to beyond 2020.

4.4.3 The report also indicates that National Grid’s planned capital investment in the facility in 2011/12 and 12/13 would be £6.0 million and £5.9 million respectively.

4.4.4 We have therefore assumed that the LNG facility within the study area will remain for the foreseeable future.

4.5 Risks

4.5.1 The risks for this study that are associated with hazardous installations include:

<table>
<thead>
<tr>
<th>Risks</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The extent of hazardous installations, their associated consultation zones and the guidance about development within those zones could change during the period to 2050.</td>
<td>Monitor changes in the COMAH zones in consultation with the HSE. The impact of these changes could be both positive (in terms of enabling additional land to be considered for development), or negative (by reducing the extent of land available for additional employment development).</td>
</tr>
<tr>
<td>The redevelopment of previously developed land within the HSE designated Inner Consultation Zones is restricted.</td>
<td>Consultation will be required with the HSE about the redevelopment potential of previously developed land within Inner Consultation Zones, particularly where the use of such land has ceased and buildings have been demolished.</td>
</tr>
</tbody>
</table>
4.6 Conclusions

4.6.1 New, major employment development is unlikely to be acceptable within the inner consultation zones around hazardous installations shown on the plan at Appendix 11. The allocation of additional land for employment development within the study area will therefore need to be restricted to areas outside these zones.

4.6.2 We have assumed that the development of the 57/58 permission will continue within the designated inner consultation zones and that the redevelopment of previously developed land may also continue within these zones.

4.6.3 It is likely that the development of a new M49 junction will need to be located outside the designated inner consultation zones.
5.0 Statutory Undertakers Services

5.1 Context

5.1.1 As part of our work, we have not:
- undertaken detailed searches of statutory undertakers services;
- investigated the capacity of such services to accommodate additional development in the area; or
- identified abnormal costs for providing any additional statutory undertakers infrastructure that might be required to serve any additional development within the study area.

5.1.2 This study therefore assumes that developers will not need to meet any abnormal costs to divert or enhance such services to serve new development.

5.1.3 Our work has however taken account of the presence of the existing above ground statutory undertakers’ services and infrastructure within the study area that includes a sewage works and overhead power lines. It has also considered the implications of the underground oil and gas pipelines within the study area.

5.1.4 The presence of over and underground mains services will limit the development potential of some parts of the study area as development will be restricted over and in proximity to such assets.

5.2 Overhead Power Lines

5.2.1 Overhead power lines are shown on the OS base plans for the study area. The area is crossed by a number of overhead power lines, particularly those linked to the Seabank Power Station that cross the central part of the study area in an east/west direction. Development of buildings will not be possible within the corridors occupied by the overhead power lines. However, it is likely that such areas could be developed with ancillary facilities such as car parking.

5.3 Pipelines

5.3.1 We have undertaken searches to identify the location of major underground oil and gas pipelines within the study area via the government’s pipeline agency at http://www.linesearch.org/

5.3.2 The searches have revealed the presence of a number of major pipelines that cross the study area and these are shown in the plans at Appendix 12. Development of buildings will not be possible within the corridors occupied by such pipelines. However, we have assumed that such areas could be developed with ancillary facilities such as car parking.
5.4 **Wessex Water Proposals**

5.4.1 Current development plan policies identify the need to expand the existing sewage works within the Avonmouth area and the Bristol Local Plan Proposals Map identifies an area adjacent to the existing works for this:

5.4.2 The area is also shown in the Council’s Site Allocations and Development Management Options consultation documents from October 2010 (although issues relating to flood risk and wildlife habitat will need to be resolved before any allocation can be confirmed):
5.4.3 We have assumed that the development of this infrastructure will be funded by Wessex Water and that it will not therefore need to be funded by development within the study area.

5.4.4 Wessex Water also has proposals (that are the subject of a current planning application) to develop 4 no. 130 metre high wind turbines, each capable of generating 3MW of electricity within its Avonmouth site.

5.5 **National Grid Proposals**

5.5.1 National Grid has consulted on proposals to provide overhead power lines to link the Hinkley Point (to the south west of the study area) and Seabank (centrally located within the study area) power stations (see information at: http://www.nationalgrid.com/uk/Electricity/MajorProjects/HinkleyConnection/ and http://www.hinkleyconnection.co.uk/).

5.5.2 National Grid’s consultation sets out options for route corridors that affect a substantial part of the study area (the extent of the study area is shown on the plan at Appendix 13). A precise route has yet to be proposed by National Grid or agreed by the Infrastructure Planning Commission. The development of new buildings will not be possible along the corridor occupied by the proposed overhead power lines. However, we have assumed that the route could be developed with ancillary facilities such as car parking.
5.5.3 National Grid did however announce its Preferred Route Corridor on the 30th September 2011 and an extract showing the study area is included below:

5.6 Risks

5.6.1 The risks for this study that are associated with statutory undertakers services include:

<table>
<thead>
<tr>
<th>Risk</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing services require substantial easements that restrict development.</td>
<td>Review detailed location of services within areas intended for further development.</td>
</tr>
<tr>
<td></td>
<td>Examine feasibility (including cost) of diverting existing services where this is necessary.</td>
</tr>
<tr>
<td>Existing services are inadequate to serve new development.</td>
<td>Investigate capacity of services to accommodate additional new development and cost of upgrading those services.</td>
</tr>
</tbody>
</table>
5.7 Conclusions

5.7.1 The presence of existing and planned over and underground services will to some extent limit the development of land within the study area.

5.7.2 We have assumed that:

- it would not be feasible to divert the existing overhead power lines or underground gas and oil pipelines to accommodate economic development within the study area and that new development must take account of these;

- the presence of existing statutory undertakers services would not unduly restrict economic development within the study area;

- it would not be possible to allocate other land for the expansion of Wessex Water’s sewage works, or to develop the allocated land for other purposes; and

- ancillary facilities (such as car parking) could be developed over (in the case of underground pipelines) or under (in the case of overhead power lines) statutory undertakers’ services.

5.7.3 Further detailed work will need to be undertaken to assess the capacity of statutory undertakers’ services to accommodate the planned development within the study area and any abnormal costs associated with the enhancement of the existing capacity. However, for the purposes of this study, we have assumed that there would not be any abnormal costs to enhance the capacity of existing statutory undertakers’ services.
6.0 Contamination

6.1 Context

6.1.1 The area has been occupied by a variety of industries, including chemical plants, waste processing facilities and power generating plant. It is likely that many of the previously developed sites within the study area suffer from a degree of contamination. There is also a risk that some of the green field land within the study area has been contaminated by past industrial activity in the area. The extent of contamination is likely to vary from site to site, depending on the past uses.

6.1.2 A brief examination of a sample of desk top and site investigation contaminated land studies submitted with planning applications for proposals on previously developed land within the study area indicate that the nature of contamination varies significantly from site to site.

6.2 Implications for the Study Area

6.2.1 It is very likely that much of the previously developed land within the study area has been contaminated from previous industrial and other uses. It is also possible that green field sites within the study area have been contaminated from activity on other land in the area. However, it is important to bring forward the development of previously developed land because new development can act as a catalyst for dealing with contamination and to avoid dereliction in the area.

6.3 Costs

6.3.1 The financial costs of mitigating contaminated land will depend on many factors including the nature of the contamination and the proposed end use of the site.

6.3.2 English Partnerships published guidance in Best Practice Note 27 (revised February 2008) Contamination and Dereliction Remediation Costs at:

http://collections.europarchive.org/tna/20100911035042/http://englishpartnerships.co.uk/landsuppl
ypublications.htm

6.3.3 However, it notes that estimating the cost of remediating previously developed land for re-use is a “complex exercise and one that is fraught with uncertainties”.

6.3.4 Although the guidance includes a range of costs for remediating contaminated/derelict land, that range is significant and depends on many factors including the complexity of the site. Bearing in mind the variety of different uses that have taken place within the study area, it is not possible to include a reliable average cost per hectare for remediating contaminated or derelict sites. The cost of remediating previously developed land should instead be included within the study as a significant risk.
### 6.4 Risks

#### 6.4.1 The risks for this study that are associated with contamination include:

<table>
<thead>
<tr>
<th>Risk</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of dealing with contamination is very high.</td>
<td>Undertake a review of contaminated land within the study area and investigate costs of mitigating known contamination.</td>
</tr>
<tr>
<td>Cost of dealing with contamination renders redevelopment for employment uses unviable.</td>
<td>Investigate options for securing funding to remediate the land.</td>
</tr>
<tr>
<td>Contamination limits the ability to develop some land.</td>
<td>Undertake a review of contaminated land within the study area and investigate costs of mitigating known contamination.</td>
</tr>
<tr>
<td>Green field land is contaminated.</td>
<td>Undertake a review of contaminated land within the study area and investigate costs of mitigating known contamination.</td>
</tr>
</tbody>
</table>

### 6.5 Conclusions

#### 6.5.1 It would not be appropriate to avoid development on previously developed or green field land that is the subject of contamination. The development of such land provides an important opportunity to ensure its remediation. We have therefore assumed that such land is suitable for development within the study area.

#### 6.5.2 However, we have not incorporated land remediation costs in this study. The potential costs of remediating land could be significant, particularly on previously developed land, but the costs will be site specific.

#### 6.5.3 Further investigation of land contamination will be required on a site by site basis as part of the development management process and more detailed feasibility work that will be required to investigate the costs of implementing the infrastructure and mitigation measures in this study.
7.0 Green Infrastructure (GI)

7.1 Context

7.1.1 The project brief requires that the need for GI provision should be taken into account with particular reference to Bristol’s Core Strategy. GI is defined in a number of different ways. South Gloucestershire Council’s definition is:

>a multi-functional network of high quality green space and linkages which operate at a variety of spatial scales. GI assets contribute to people’s well-being, and together comprise a coherent managed resource responsive to evolving conditions.

and Bristol City Council’s definition is:

>the term used to describe the network of green assets that can work together to support sustainability and quality of life within and around Bristol.

7.1.2 Both Bristol and South Gloucestershire’s Core Strategies promote the provision of GI within the study area.

7.1.3 South Gloucestershire Council’s Core Strategy shows much of the Severnside area as being Strategic GI, notwithstanding other Core Strategy policies that identify the land for employment development. The following extract from the Core Strategy shows GI throughout the Council’s area, including the study area:
7.1.4 The more detailed extract below shows the proposed "strategic recreation and cycle routes" through the study area that would link with the GI corridors in the Bristol Core Strategy:

7.1.5 Bristol’s Core Strategy shows indicative areas within the Avonmouth area on the following plan:
7.2 Implications for the Study Area

7.2.1 Development within the study area will need to make provision for GI in accordance with the Core Strategies. However, the precise nature and extent of the GI will need to be established through each Council’s Site Allocations DPD.

7.2.2 It is recommended that the GI corridors should be at least 25m wide and 500m long and should incorporate the retention of existing landscape and habitat features, such as rhynes and hedges.

7.2.3 The broad approach that we have assumed in this study is that GI corridors of at least 25m wide will be required in both a north/south and east/west direction through the study area. These corridors could take a number of different forms, but should seek to follow existing GI features.

7.2.4 The indicative plans in each Council’s Core Strategy indicate that green corridors are likely to be required alongside the existing railway line and along the coastal fringe of the study area. A corridor will also need to be reserved through the central part of the study area running between the coastline and M49.

7.2.5 In the context of the developed nature of the Avonmouth area south of the railway line and the 57/58 permissions in the north of the study area, the provision of GI will principally be restricted to the coastal zone in these parts of the study area.

7.3 Costs

7.3.1 The need to provide GI (and the corridors linking the Avonmouth and Severnside areas):
  - could be combined with other mitigation requirements including ecological mitigation, COMAH zones etc; and
  - supports our assumption about the density of any new development within the study area (see section 14.0 below).

7.3.2 We have not therefore incorporated a separate infrastructure cost within this study to provide GI, but have assumed that it will be provided through the normal development management process and as part of the requirement to mitigate the impact of development on the area’s ecology.

7.4 Phasing

7.4.1 The development of new, or retention of existing green infrastructure is likely to come forward on a phased basis in parallel with individual developments and the ecological mitigation outlined in section 10.0.

7.5 Risks

7.5.1 The risks for this study that are associated with GI include:

<table>
<thead>
<tr>
<th>Risks</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>GI requirements are not co-ordinated with the requirement to provide ecological mitigation/COMAH zones etc.</td>
<td>Ensure that GI provision is linked to other mitigation requirements to minimise the requirement for additional GI</td>
</tr>
</tbody>
</table>
7.6 Conclusions

7.6.1 The further development of the study area will need to be co-ordinated to retain existing and provide new and enhanced GI in accordance with emerging development plan policies. The provision of GI will need to be incorporated within each Council’s Site Allocations DPD. Its provision will however need to be closely linked to the requirements to mitigate the impact of development on the area’s ecology and any requirements to retain undeveloped corridors within the study area for services, COMAH zones etc.

7.6.2 Where planning permission is required for development within the study area, GI can be required within specific development proposals. It may also be possible to secure funding for the provision and future maintenance of GI through planning conditions and s106 agreements for individual developments.

7.6.3 Finally, some GI will be provided as mitigation for the ecological impacts of the development identified in section 10.0.
8.0 Landscape

8.1 Context

8.1.1 The study area is not the subject of any local, regional or national landscape designations.

8.1.2 It is however within Natural England’s Severn and Vales Character Area 106 (http://www.naturalengland.org.uk/Images/jca106_tcm6-5557.pdf). The description of the area notes that it includes a diverse range of flat and gently undulating landscapes, united by broad river valley character. It also notes that in the vicinity of the study area, the industrial complexes of Avonmouth and the riverside power stations dominate the landscape.

8.1.3 South Gloucestershire Council published a Landscape Character Assessment SPD of its area in 2005 (http://hosted.southglos.gov.uk/landscapecharacterassessment/main%20doc-internetR1.pdf). It describes the northern part of the study area (Landscape Character Area 21 – Severn Shoreline and Estuary) as having an “open and exposed simple landscape…” dominated and influenced by the physical and visual presence of the estuary. It notes how the flood defences in the area form a “wall” between the unenclosed estuary landscape to the west and (in part) the enclosed agricultural fields to the east within the central part of the study area. The defences act as a prominent and defining feature and it is noted that defences have been a feature of this part of the estuary for some time.

8.1.4 The SPD also notes the prominence of large scale industry within the area and comments that “potential substantial future development” would result in “significant further visual intrusion to the shoreline and Estuary further eroding the rural character and perception of remoteness within the area.”

8.1.5 Cresswell’s study (see section 12.0) notes that across much of the green field part of the study area, many of the fields contain a ridge and furrow landform.

8.2 Implications for the Study Area

8.2.1 Further development on green field land within the study area is likely to have a significant impact on the area’s landscape. In particular, within the central part of the study area that is dominated by enclosed fields, further substantial development will have a negative impact on this landscape. Although new planting would be possible in conjunction with new development, it is unlikely to mitigate the large scale of modern industrial and warehouse development.

8.2.2 The redevelopment of previously developed land in the north and south of the study area is, depending on its height, mass and bulk, likely to have less of a landscape impact than the development within the central part.

8.2.3 In particular, development within the Avonmouth area to the south of the freight railway line is likely to have the least impact since much of this area is already developed with large scale industrial and storage and distribution buildings and the Port and its associated uses.

8.2.4 Further development along the coast will be prominent from views within and across the estuary and, again, development adjacent to the coast within the central part of the area is likely to have the most significant negative effects.
8.2.5 The opportunity to develop a flood defence along the western boundary of the site will have an impact on the landscape of the study area, but this impact will depend on the height and design of any such structure.

8.3 Costs

8.3.1 Mitigation for the landscape impact of new development will be required on green field and previously developed sites within and around development. However, the cost of such landscaping will be part of the “normal” cost borne by developers of individual sites.

8.3.2 The density of development that we have anticipated on land allocated for development takes account of the need to incorporate landscaping to mitigate the impact of that development.

8.4 Risks

8.4.1 The risks for this study that are associated with landscape impact include:

<table>
<thead>
<tr>
<th>Risks</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landscape impacts of development, particularly on green field land are unacceptable and can not be mitigated.</td>
<td>Review whether other benefits of development outweigh the perceived landscape harm.</td>
</tr>
</tbody>
</table>

8.5 Conclusions

8.5.1 Although the area is not the subject of any specific landscape designations, its development with further industrial and warehouse development will inevitably have a significant impact on its landscape.

8.5.2 The landscape impact of new development is likely to be greatest on green field sites. In particular, the provision of large scale industrial, warehouse and distribution and sui generis uses on green field sites within the central part of the study area will have a significant impact on the landscape.

8.5.3 In the context of the above and the Councils’ Vision in the Project Brief, proposals for new development within the study area will need to incorporate measures to, where possible, retain existing landscape features and provide new landscaping to mitigate their impacts. In particular, development of green field sites should seek to retain and enhance existing hedges and water courses. However, in seeking to ensure that the area fulfils its economic development potential, the Councils will need to acknowledge that it will not be possible to fully mitigate the landscape impacts of further development in the area.
9.0 **Archaeology/Heritage**

9.1 **Context**

9.1.1 The Severn Levels, including the study area, is an area of high archaeological potential because of the level of preservation of archaeological and palaeo-environmental remains surviving within the waterlogged silt deposits and peat layers. The Workshop and Bristol and South Gloucestershire Council’s Local Plans and Core Strategies highlight the area’s archaeological potential.

9.1.2 Development within the study area could result in the destruction of archaeological remains and could also indirectly affect water levels on adjacent land which could in turn affect the survival of waterlogged deposits.

9.1.3 The area’s landscape is, within the central part of the study area, also of historic significance. The central part of the study area remains in agricultural use and comprises historic field boundaries, drainage channels and important hedgerows as well as the increasingly rare survival of ridge and furrow earthwork remains of medieval cultivation.

9.1.4 Development plan policies to protect heritage assets, including archaeology, are set out in each Council’s Local Plan and Core Strategy and PPS5 – Planning for the Historic Environment. In particular, both Councils’ Core Strategies seek to protect and conserve the area’s archaeological heritage and interest. PPS5 requires that where development affects heritage assets, designated or not, an assessment of the significance of these assets is undertaken and appropriate mitigation included in support of applications for development.

9.1.5 The plan at Appendix 14 identifies the designated heritage assets and the location of Sites and Monuments records within the study area.

9.1.6 The study area only contains two designated heritage assets – two scheduled monuments:
- SM28885 WW2 Anti-Aircraft Battery near Rockingham Farm; and
- SM27988 Mere Bank sea defences and flanking ditches;

both within the Avonmouth area. However, the study area is potentially of much greater archaeological significance than is suggested by the limited number of designated heritage assets.

9.1.7 The recently published English Heritage sponsored Rapid Coastal Zone Assessment covering the English shoreline of the Severn estuary is the most recent study to have demonstrated the wealth of archaeology occurring within the area. Section 6.7 of the Phase 1 Report (see: [http://www.english-heritage.org.uk/content/publications/docs/Severn_RCZAS_Phase_1_2009.pdf](http://www.english-heritage.org.uk/content/publications/docs/Severn_RCZAS_Phase_1_2009.pdf)) makes particular reference to the study area’s archaeology.

9.1.8 The area is a flood plain at the confluence of two rivers and has a long history of human settlement. Bristol City Council’s SPD 7 – Archaeology and Development (2006) notes that:

_The wetlands of the Severn Estuary have produced evidence for man’s utilisation of this landscape from at least the late Bronze Age at Avonmouth ..._

9.1.9 South Gloucestershire Council has published SPG about archaeology in the Severnside area that highlights the potential importance of the area’s archaeology that is available at:
9.1.10 The nature of the sub soil means that archaeological remains within the area are well preserved and evidence has been found of neolithic, iron age, Roman, Saxon and Medieval settlements. Furthermore, parts of the visible landscape and drainage system within the central, undeveloped part of the site are of medieval origin and therefore of significant historic interest. There is therefore a high probability that green field land within the study area contains a variety of archaeological deposits.

9.1.11 Previously developed land within the study area may also contain a variety of archaeological deposits, although it is likely that earlier development on such areas will have disturbed those deposits.

9.1.12 Broad analysis of the area’s archaeology is contained within the numerous reports (including environmental statements) that have accompanied planning applications within the study area. Reference has been made to a number of these in completing this study.

9.2 Implications for the Study Area

9.2.1 The report notes that the “Hold the Line” policy on flood risk will mean that existing flood defences in the area will be maintained for the long-term although there may be some erosion of the coastal salt marsh. The existing flood defences are expected to fail, but they will be reconstructed and enhanced.

9.2.2 This approach means that potential changes in the area caused by increased flooding, erosion, ‘coastal squeeze’ and/or the construction of new flood defences could impact upon prehistoric peat and alluvium deposits, prehistoric occupation deposits, areas of ridge and furrow, post-medieval land drainage and phases of river bank defences, and Second World War features. There will therefore need to be an archaeological assessment of the impact of intertidal and foreshore erosion and ‘coastal squeeze’ as part of any future flood risk management plans.

9.2.3 Although further development within the study area is unlikely to have a significant and direct impact on the small number of designated heritage assets, the study area does include a rich archaeological landscape.

9.2.4 Development of currently undeveloped areas may have a harmful impact on archaeology. Although the development of the 57/58 permission is able to continue without the need for mitigating its impact on the area’s archaeology, elsewhere within the study area, developers will be expected to follow current good practice and assess the significance of archaeological remains affected by development and provide appropriate mitigation.

9.2.5 Further investigation will be required of the parts of the study area where further development is proposed. The further investigation is likely to include field evaluation, particularly on green field land, on a site by site basis.

9.2.6 Where development is desirable on green field land to help realise the area’s economic development potential, site investigation will be necessary prior to development commencing. If archaeological or palaeo-environmental deposits are found during site investigation, an assessment will need to be made as to whether the foundations and groundworks for development within the area need to be adjusted to take account of important archaeology.
9.2.7 Where detailed investigations reveal significant potential for important archaeological remains, a programme of excavation and recording, followed by analysis, report preparation and publication, may also be required as mitigation.

9.2.8 If further investigation reveals archaeology of national importance, it may be necessary to preserve that archaeology in situ.

9.3 Costs

9.3.1 The cost of undertaking archaeological field evaluation is likely to be taken into account by developers in their purchase of land and buildings for development within the study area. The costs are unlikely to be high, but could be in the region of £10-25k per hectare where there is a requirement for field evaluation. Costs could of course be substantially higher in the event that archaeology is identified that requires mitigation.

9.3.2 Within the area covered by the 57/58 permissions, there is no requirement on developers to investigate the site’s archaeology and therefore no associated costs (although the Council would expect developers to follow current archaeological good practice and provide archaeological mitigation).

9.4 Risks

9.4.1 The risks for this study that are associated with its archaeological importance include:

<table>
<thead>
<tr>
<th>Risks</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Important archaeology is present that requires preservation &quot;in situ&quot; rather than by recording and this restricts the area available for development.</td>
<td>Field evaluation of individual sites will be required as they come forward for development, The risk will be highest on green field land.</td>
</tr>
</tbody>
</table>

9.5 Conclusions

9.5.1 There are relatively few statutorily designated heritage assets within the study area. The impact of further development on these could often be mitigated at a local level, although in some circumstances the impacts of development on their settings could be from a wide area.

9.5.2 However, the impact of further development in the area on its undesignated heritage assets, including the historic landscape of the area and below ground archaeology, could be significant in the absence of appropriate mitigation.

9.5.3 Mitigation in the study area is likely to comprise desk top study, field evaluation and preservation of archaeological remains by record, rather than by preservation "in situ".

9.5.4 Where further evaluation reveals archaeology of national importance, it is likely that preservation will be required in situ. However, the likelihood of archaeology of such importance being present within the study area is relatively low on the basis of investigations that have taken place to date in connection with planning applications within the study area.

9.5.5 The Councils will need to consider the weight to be attached the area’s undesignated heritage assets, particularly the area’s archaeology, in the context of the desire to see the area fulfil its
economic development potential. However, for the purposes of this study, we have assumed that the preservation of the area’s archaeology will, where disturbance is required to accommodate development, principally be by record rather than in situ.
10.0 Ecology

10.1 Context

International and National Designations

10.1.1 In recognition of its internationally important natural features and wildlife, the Severn Estuary is protected by a range of national and international nature conservation designations and associated legislation.

10.1.2 As well as being notified as a Site of Special Scientific Interest (SSSI), it is also designated as a Special Protection Area (SPA) and a Ramsar site. The Severn Estuary is also a candidate Special Area of Conservation.

10.1.3 The SPA designation means that the fields alongside the Estuary that are visited by wildfowl have the same legislative protection as the estuary itself.

10.1.4 South Gloucestershire Council’s Core Strategy notes that:

The Habitat Regulations also require an Appropriate Assessment to be carried out to understand the likely impacts of the extant permissions on the European designations and to address mitigation options. This presents a challenge in realising development at Severnside whilst reconciling it with the continued use of the coastal floodplain by wildfowl and compliance with the Habitat Regulations.

10.1.5 The Councils therefore commissioned a separate report from Cresswell Associates/Hyder about the opportunities for mitigating the impact of the existing and planned development in the area covered by the 57/58 permissions and the redevelopment of previously developed land within the Avonmouth area in accordance with the Habitat Regulations.

Local Designations

10.1.6 The study area is also the subject of a number of local nature conservation designations (see plan at Appendix 15), including Sites of Nature Conservation Interest (SNCI) and Wildlife Networks that are shown on Bristol City Council’s draft Site Allocations LDF Proposals Map.

10.1.7 There are also locally designated areas in proximity to the study area, including Local Nature Reserves (e.g. Lawrence Weston Moor LNR that is about 0.5km to the south east of the area).

Protected Species

10.1.8 Surveys, including those that have been submitted to accompany planning applications for development, indicate that protected species are present in the study area.

Cresswell Associates/Hyder Study

10.1.9 The study reviews the 1957/58 Severnside Planning Consent (as required under The Conservation of Habitats and Species Regulations, 2010) to enable the competent authority (South Gloucestershire Council) to undertake an Appropriate Assessment. It also includes an impact assessment of likely development which could take place within the Avonmouth employment area and potentially feasible wind farm sites identified within the Bristol Citywide Sustainable Energy Strategy.

10.1.10 The study is based on assumptions about the areas which were either:

- likely to be lost to the proposed developments within the study area; or
likely to include processes which would either disturb or displace the aforementioned bird species using adjacent habitats.

10.1.11 The Review of Consent in the study identifies that predicted future development-related habitat losses and disturbance events at Severnside could have potentially significant impacts upon wintering gadwall (a Qualifying Species for the Severn Estuary SPA), and several waterfowl species forming part of the Qualifying Assemblage (specifically gadwall, teal, tufted duck, curlew, mallard, lapwing and common snipe). It is predicted that these impacts could give rise to potentially significant effects upon the integrity of the SPA and Ramsar site.

10.1.12 The study also identifies that future development-related habitat losses, disturbance and displacement at Avonmouth could have potentially significant impacts upon wintering gadwall (a Qualifying Species for the Severn Estuary SPA) and several species forming part of the Qualifying Assemblage (specifically gadwall, teal, tufted duck, curlew, mallard, lapwing and common snipe).

10.1.13 The potential effects of displacement upon waterfowl within the assessment relate to potential feasible wind farm sites only (as identified within the Bristol Citywide Sustainable Energy Strategy (BCSES)) It is predicted that these potential impacts could also give rise to potentially significant effects upon the integrity of the SPA and Ramsar site, either alone or in combination with other plans and projects in the wider surrounds.

10.1.14 The study suggests six areas for potential habitat mitigation measures to offset the identified impacts of development in the study area (see plan at Appendix 10):

<table>
<thead>
<tr>
<th>Site</th>
<th>Description</th>
<th>Approximate Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Fields North of M4 Bridge</td>
<td>14 ha</td>
</tr>
<tr>
<td>B</td>
<td>Fields at Whitehouse Farm</td>
<td>25 ha</td>
</tr>
<tr>
<td>C</td>
<td>Hallen Marsh</td>
<td>112 ha</td>
</tr>
<tr>
<td>D</td>
<td>Berwick Farm Landfill</td>
<td>30ha</td>
</tr>
<tr>
<td>E</td>
<td>Former Northwick Landfill Site</td>
<td>10ha</td>
</tr>
<tr>
<td>F</td>
<td>WAP 1 Ecological Refuge Area</td>
<td>38ha</td>
</tr>
</tbody>
</table>

**Total Area** 229ha

10.1.15 The study recommends that **63ha** (**22ha** from Severnside and **41ha** from Avonmouth) of new wetland habitat is required to off-set the potential impacts which have been predicted in relation to gadwall and the wildfowl species forming part of the Qualifying Assemblage.

10.1.16 The study recommends that the following potential mitigation sites be the subject of further investigation as to their suitability for the creation of new wetland habitat:

- the former Berwick Land fill site (Area D);
- the former Northwick Landfill Site (Area E); and
- the Ecological Refuge Area (F).
10.1.17 The study also recommends that **73.2ha (46.6ha from Severnside and 27.6ha from Avonmouth)** of habitat for waders would need to be created/enhanced to off-set the potential future habitat losses which have been predicted.

10.1.18 The predicted habitat loss at Severnside could affect numbers of lapwing which equate to approximately 1% of the total SPA Qualifying Assemblage. It is therefore also recommended that measures to create/enhance **46.6ha** of the **73.2ha** of habitat for waders be targeted specifically towards lapwings (albeit these mitigation proposals would also be expected to confer benefits to curlew and common snipe, given the degree of overlap between these species’ habitat requirements).

10.1.19 The study recommends that the following potential mitigation sites be the subject of further investigation as to their suitability for the creation/enhancement of habitat for waders and lapwings:

- Hallen Marsh (Area C);
- the former Berwick Landfill site (Area D);
- the former Northwick Landfill Site (Area E); and
- the Ecological Refuge Area (F).

10.1.20 The study also notes that there is “uncertainty as to whether it would be feasible to utilise Areas A & B for use as long-term mitigation areas”, but suggests that the extent of habitat mitigation in Area C could be reduced in size if these areas were suitable for mitigation.

10.1.21 In total, the Cresswell study recommends that ecological mitigation be considered across 6 sites within the study area with a total area of approximately **133.4ha**. Of this total area, **38ha** will be provided in accordance with the requirements of the s106 agreement attached to the WAP 1 permission. This leaves a requirement for a further **95.4ha** of land for ecological mitigation.

10.1.22 The table below summarises the habitat mitigation recommendations identified in the Cresswell study:

<table>
<thead>
<tr>
<th>Site</th>
<th>Mitigation Requirement</th>
<th>Potential Areas</th>
<th>Approximate Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wetland habitat for gadwall and wildfowl</td>
<td>D, E, F</td>
<td>63ha</td>
</tr>
<tr>
<td></td>
<td>Habitat for waders</td>
<td>C*, D, E, F</td>
<td>73.2ha (of which 46.6ha is required for habitat for lapwings)</td>
</tr>
</tbody>
</table>

**Total Mitigation Requirement**

10.1.23 The report notes that the identification of the mitigation sites has not considered the issues of flood risk, land use/ownership, existing hydrological conditions, or the presence of other ecology/protected species issues.

10.1.24 The report recommends that the feasibility of habitat creation/enhancement works at the potential mitigation sites should be subject to further investigation (including the willingness of the current
landowners to accommodate such mitigation). Furthermore, it notes that the location and extent of future wind farm development at Avonmouth could significantly compromise the effectiveness of the proposed mitigation sites, and would need to be carefully reviewed. Notwithstanding this, it predicts that, in the event that the requisite levels of mitigation are delivered, significant impacts upon the integrity of the Severn Estuary SPA and Ramsar site would be “unlikely to occur”.

10.2 Analysis of the Central Undeveloped Part of the Study Area

10.2.1 The focus of this report is in seeking to identify how the area can best accommodate further economic development to meet its full potential. It is therefore important to consider the opportunity for further development beyond that considered in the Cresswell study.

10.2.2 The main area with potential for further economic development beyond the areas considered in the Cresswell report is the central, undeveloped, green field part of the study area that also includes one of the potential mitigation sites suggested in the Cresswell report (Area C). It is likely that the development of further green field land will require additional mitigation.

10.2.3 The Cresswell study notes that the undeveloped land within the central part of the study area:

*predominantly comprises a network of improved grassland fields, which are subject to a heavy grazing regime and bisected by a network of interconnected drainage ditches, and mature hedgerows*

10.2.4 Figure 1 (see Appendix 16) and the Description of Terrestrial Habitats in section 3.2 of Appendix III to the study outlines the broad range of habitats present on the green field land within the study area in more detail.

10.2.5 The study concludes that, in principle, the grazing pasture in the central part of the study area “appeared to be potentially suitable for use by roosting and (to some extent) foraging wintering waterfowl”, although it notes that the majority of the area is surrounded by a network of mature hedgerows and trees which restrict sight-lines.

10.2.6 In particular, the green field land in the north of the central part of the study area is noted as being “bisected by a well-established hedgerow network which limited the field sizes”. As a result, it was considered less likely that it would support large flocks of wildfowl and waders. However, the study also notes that evidence from other surveys suggests that the presence of these hedges and trees need not inhibit the use of the area by these birds.

10.2.7 The southern part of the undeveloped central area (the potential mitigation Area C identified in the Cresswell study) is however identified as having larger fields with better sight lines and therefore greater potential for use by wintering waterfowl. It is also noted that this area has, from previous surveys, supported relatively low numbers of birds, relative to its large size, diversity of habitat types and low levels of disturbance, etc.

10.3 Mitigation for Additional Economic Development

10.3.1 In addition to the requirements identified in the Cresswell study to mitigate the existing and planned development within the study area, there will be a requirement to identify additional land for mitigation in the event that further green field land is required for economic development.

10.3.2 In this study, we have broadly assumed that the area of land required for ecological mitigation will be broadly the same as the area of additional green field land that is required for economic
development. However, as we have assumed that the density of development on any green field sites will need to include proposals to enhance about 5% of the overall site area for ecology, we have assumed that the additional area of land required for mitigation will comprise 95% of the green field land area required for economic development.

10.3.3 This broad approach is a conservative estimate of the land required for ecological mitigation to facilitate the development of green field land. We have taken this approach in the absence of up to date and detailed surveys of the use of specific parts of the study area by birds using the SPA.

10.3.4 Up to date surveys may indicate that the additional green field land being considered for development is not currently used extensively by species in association with the SPA and that a lesser area of land could be made available to meet the mitigation requirements.

10.3.5 In identifying options for sites to provide ecological mitigation, the optimum solution will be to incorporate as much of the area required in as few sites as possible. The overall approach should therefore be to combine the mitigation required in the Cresswell study with the mitigation required for the development of any additional green field land.

10.4 Mitigation for Infrastructure

10.4.1 Proposals to raise the existing flood defences or develop new flood defences, the raising of land levels and the development of new highways (including the M49 junction and associated spine and link roads) could all have significant effects on the SPA and proposals for ecological mitigation sites. The impact of infrastructure requirements in the study area on the SPA will therefore require investigation as detailed proposals for this infrastructure is brought forward.

10.5 Existing Habitats and Protected Species

10.5.1 Detailed site-specific surveys will be required to determine the biodiversity of sites proposed for economic development and the presence of protected species.

10.5.2 The study area supports a number of protected species. Proposals for the study area should aim to retain and enhance existing important habitats.

10.6 Interaction with GI Requirements

10.6.1 Proposals for ecological mitigation within the study area will need to take into account the requirements for GI corridors running through the study area in both north/south and east/west directions. Areas set aside for ecological mitigation could also form part of the required GI corridors throughout the study area.

10.7 Appropriate Assessment

10.7.1 The preferred option for taking forward the area’s economic development, including any associated infrastructure development (including the raising of the existing flood defences and development of a new motorway junction) will need to be the subject of a formal Assessment under the Habitat Regulations to identify if there will be any "significant effects” on the SPA.
10.8 Costs

10.8.1 The costs for preparing sites for ecological mitigation will depend on a wide range of factors including the:

- ecological features of the existing site, including the presence of landscape features and protected species;
- hydrological conditions;
- ground conditions/geology;
- contamination;
- topography;
- land ownership and management requirements; and
- the specific design of the ecological mitigation measures.

10.8.2 Further detailed, site specific information about the above matters will be required to robustly assess the costs of providing mitigation. However, for the purposes of this study, we have assumed that the land required for ecological mitigation will be:

- available at a value that broadly reflects its current agricultural/horse grazing use; and
- suitable for such purposes (including being free from contamination and having suitable ground and hydrological conditions).

10.8.3 The precise cost of preparing and managing land for ecological mitigation will also depend on the precise nature of the works required, but we have identified a similar scheme of mitigation undertaken on about 45ha of Council owned land at Dowlais Farm in Clevedon, North Somerset. The scheme created wetland habitat for use by breeding waders on existing agricultural land.

10.8.4 The overall cost of the works at Dowlais Farm was in the region of £0.6million, equivalent to a cost of about £15k/ha. The work was completed in 2008/9 and we have therefore assumed that similar works today could cost in the region of £20k/ha.

10.8.5 The ongoing management costs at Dowlais Farm are limited because the land continues to be farmed extensively in a manner that supports its ecology.

10.8.6 The mitigation costs for the existing and committed development on the 38ha of land identified in the WAP 1 s106 agreement will be met by the developers of the WAP 1 land. The costs for the remaining 95.4ha of ecological mitigation identified in the Cresswell study are likely to be in the region of:

<table>
<thead>
<tr>
<th>Item</th>
<th>Calculation</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Acquisition/Agreement Cost</td>
<td>95.4 x £12.5k</td>
<td>£1.2 million</td>
</tr>
<tr>
<td>Works Cost</td>
<td>95.4 x £20k</td>
<td>£2 million</td>
</tr>
<tr>
<td><strong>Total Cost</strong></td>
<td></td>
<td><strong>£3.2 million</strong></td>
</tr>
</tbody>
</table>
10.8.7 The above cost estimate assumes that the sites are suitable for such mitigation and do not require any significant remediation.

10.9 **Mitigation Costs – Additional Development**

10.9.1 The development of additional land for economic development will require that additional land be set aside for ecological mitigation. On the basis of the above cost estimates, the cost of providing ecological mitigation for 1ha of development land will be in the region of:

<table>
<thead>
<tr>
<th>Item</th>
<th>Calculation</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Acquisition/Agreement Cost</td>
<td>1 x £12.5k</td>
<td>£12.5k</td>
</tr>
<tr>
<td>Works Cost</td>
<td>1 x £20k x 0.95</td>
<td>£19k</td>
</tr>
<tr>
<td><strong>Total Cost Per Ha</strong></td>
<td></td>
<td><strong>£31.5k</strong></td>
</tr>
</tbody>
</table>

10.9.2 Additional economic development in the study area will require that land be set aside for ecological mitigation. On the basis that an additional area of about 62.7ha of green field land could be brought forward for economic development, the cost of providing ecological mitigation for that land will be in the region of £1.8 million.

10.10 **Mitigation Costs – Total**

10.10.1 The total cost of ecological mitigation will therefore be in the region of £5 million assuming that suitable land can be acquired at agricultural land values and that ecological mitigation costs will be similar to those at Dowlais farm in North Somerset.

10.11 **Phasing**

10.11.1 The principal ecological mitigation measures will require the enhancement of existing land within or in proximity to the study area.

10.11.2 The phasing of the ecological mitigation will need to keep pace with development in the study area. However, it is anticipated that an initial phase of mitigation will be required to address development that has taken place to date within the study area.

10.11.3 Site specific ecological mitigation will be required with individual developments.

10.12 **Risks**

10.12.1 The significant risks associated with the requirements to mitigate the impacts of the area’s development on its ecology include:

<table>
<thead>
<tr>
<th>Risks</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>There are inadequate sites available for ecological mitigation for the existing and planned development in and around the study area.</td>
<td>Review option of providing ecological mitigation away from the study area (this approach is being pursued in connection with the development of the Port’s DSTC).</td>
</tr>
<tr>
<td>The funding available to undertake the works required to mitigate the impacts of the existing and planned development on the area’s ecology is inadequate.</td>
<td>Investigate all potential funding sources.</td>
</tr>
<tr>
<td>Development or mitigation has a negative impact on protected species or designated areas.</td>
<td>Undertake site surveys and plan for enhanced habitats to facilitate protected species and other mitigation.</td>
</tr>
<tr>
<td>Land owners are unwilling to make land available for ecology mitigation.</td>
<td>Review whether CPO powers could be used to secure land for ecology mitigation. Ensure that a range of different sites are available for mitigation.</td>
</tr>
<tr>
<td>Cost of acquiring land for mitigation or providing mitigation are higher.</td>
<td>Investigate opportunities to acquire land with land owners, undertake further investigations on that land and</td>
</tr>
<tr>
<td>Further studies reveal that sites identified for mitigation are already being used to capacity by the species for which they are intended.</td>
<td>Undertake detailed surveys of potential mitigation sites.</td>
</tr>
<tr>
<td>Sites identified for mitigation are unsuitable.</td>
<td>Undertake more detailed site surveys of ground conditions etc.</td>
</tr>
<tr>
<td>Other infrastructure has an adverse impact on the area’s ecology.</td>
<td>Assess ecological impacts of other infrastructure requirements (e.g. M49 junction and flood risk mitigation).</td>
</tr>
</tbody>
</table>

### 10.13 Conclusions

10.13.1 The requirement to mitigate the impacts of the existing and planned development on the SPA is outlined in the Cresswell study. The study sets out mitigation options that will require further investigation to identify whether the sites are suitable and whether agreement can be reached with the current land owners to bring forward that mitigation.

10.13.2 The Cresswell study identifies that 38ha of land will need to be identified for ecological mitigation in accordance with the s106 agreement attached to the WAP 1 permission. A further 95.4ha of land will need to be provided for ecological mitigation for the current anticipated development in the area.

10.13.3 If further green field development is planned within the study area, 1ha of land will be required for mitigation for each 1ha of land to be developed.
10.13.4 The Cresswell study identifies 6 sites that may be suitable for ecological mitigation with a total land area of 229ha. The study therefore identifies about 100ha of land that could be available for ecological mitigation beyond that which will be required to mitigate the impacts of the currently planned development in the study area.

10.13.5 The feasibility of habitat creation/enhancement works at the potential mitigation sites should be subject to further investigation. It is predicted that, in the event that the requisite levels of mitigation are delivered, significant impacts upon the integrity of the Severn Estuary SPA and Ramsar site would be unlikely to occur.
11.0 Transport

11.1 Context

11.1.1 The area already benefits from the presence of the Port and its proximity to the main motorway network that serves south west England, south Wales and beyond. Its location therefore makes it attractive for the development of major warehousing and distribution premises, waste processing (that serves a wide area) and Port related uses.

11.1.2 Further investment in transport infrastructure in the area, particularly in the form of a new motorway junction and the supporting link and spine roads, is likely to further enhance the attractiveness of the area for the development of warehousing and distribution premises.

11.1.3 The Planning Policy section of this report outlines both Councils’ long standing desire to secure improvements to the area’s transport infrastructure, including a new junction on the M49 to better serve the area. This desire arises from previous work undertaken by the Councils that indicated that the area’s transport infrastructure is inadequate and that further development within the area is likely to harm the wider transport network.

11.1.4 Current development plan policies also seek to enhance public transport and opportunities to walk and cycle to and from the study area.

11.1.5 The area’s development over the last 10 years does not appear to have been hindered by the absence of the transport infrastructure identified in current and emerging development plan policy. However, the Councils remain concerned that the continuing development in the area (particularly of the undeveloped areas covered by the 57/58 permission) will result in unacceptable transport implications that could deter future investment in the area and harm the amenity of people living in proximity to existing routes.

11.2 M49 Junction

11.2.1 This study does not include modelling of the transport impacts of development on the area, but instead relies on the conclusions that have informed development plan policies to date. These emphasise the need to provide a new M49 junction to serve the planned growth in the area. We have assumed that a new motorway junction will be necessary to serve development in the area to 2050 and beyond and that the transport implications of development without the junction will be unacceptable.

11.2.2 Proposals for a new M49 junction and associated linking roads are shown in:

- various development plan documents (see section 3.0);
- the outline planning application for the WAP 1 development (see section 2.4); and
- current marketing material for the Central Park development (see Appendix 17).

11.2.3 Both Councils have therefore, for some time, held aspirations to enhance the area’s accessibility and to mitigate the transport impacts of development by way of a new M49 junction and other transport infrastructure.

11.2.4 The new M49 junction and the associated spine and link roads are the most significant transport infrastructure identified in development plan documents (excluding Bristol Port’s DSTC).
11.3 Other Studies

11.3.1 The costs and benefits of a new M49 junction were examined in the West of England Partnership’s Greater Bristol Strategic Transport Study (GBSTS - http://www.westofengland.org/transport/gbsts). At the time of the study (2006), only modest growth was assumed within the area and it concluded:

**M49/Severnside Intermediate Junction**

Projected increases in employment within the Severnside area are not sufficient to justify the potential highway improvements which include a new junction on the M49 and construction of a Spine Road through the main development area. While there are potential travel time savings for traffic to/from Severnside, the volume of traffic is small and the benefits do not justify the high scheme costs.

**Extract from GBSTS Showing M49 Junction and Spine Road**

Figure 6.24 – Alignment of M49 Intermediate Junction

Note: The schemes in this diagram are conceptual and defined for appraisal purposes.

11.3.2 We have not examined the planned growth anticipated in the study area in the GBSTS, but the purpose of this report is to look forward to 2050. If the Councils are to realise their shared vision to 2050, it is likely that development in the study area will be greater than that anticipated in GBSTS.
11.4 M49 Junction Location

11.4.1 It may be possible to develop a new M49 junction in a number of different locations. The documents studied to inform this report illustrate three different options in the:

- indicative plan in the South Gloucestershire Local Plan (see section 3.7.6);
- plan in the WAP 1 s106 agreement (see section 2.4); and
- plan above (in section 11.3.1) from the GBSTS study.

11.4.2 However, as outlined in section 5.0, the HSE’s PADHI guidance states that Major Transport Links in their own right (i.e. not as an integral part of other developments) fall within sensitivity Level 2 where the HSE would normally advise against such development within Inner Consultation Zones. The HSE may advise that the junction should, from a health and safety perspective, be located further north or south than is shown in each Council’s indicative plans within their Local Plans and Core Strategies to avoid the LNG Inner Consultation Zone. Discussions will be required with the HSE about the options for the location of a new M49 junction.

11.4.3 The junction would need to be linked to the existing highway network in the area, including the A403. Previous developments in the area have also incorporated new highways to link to the anticipated “spine road” that is shown as an indicative route on the plans in section 3.0 linking the Avonmouth and Severnside areas in parallel to the A403.

11.4.4 The developers of Central Park, Severnside Distribution Land Ltd have been progressing the development of the section of a “spine road” through the area covered by the 57/58 permissions (see marketing brochure at Appendix 17). Aerial photographs taken in January 2012 illustrate that the road is under construction across their site (see photo below taken from http://www.centralparkbristol.co.uk/).
11.4.5 Planning permission has also now been granted to SITA UK for the development of an Energy Recovery Centre on site SG39 South of Severnside Works in the JWCS (http://www.westofengland.org/media/202981/jwcs%20-%20full%20page%20v8.pdf) under the reference PT09/5982/FMW. The permission includes a new roundabout on the A403 and a section of “spine road” along the site’s southern boundary that could form part of a link to the spine road that is being developed through the Central Park development (see the plan at: http://developments.southglos.gov.uk/online-applications/files/055377E024B9C761B47965D3D63C552A/pdf/PT09_5982_FMW-PROPOSED_A403_ROUNDABOUT___SPINE_ROAD-_03_12_09-3693215.pdf). This is illustrated on the plans at Appendix 10.

11.4.6 The Transport Assessment that accompanied the SITA application states that the new roundabout and road “will be designed to form the southernmost section of a new Severnside spine road”. It also states that it was the applicant’s understanding that it will serve as the primary route through Severnside and that the A403 will be downgraded and that all HGV traffic will use the spine road.

11.4.7 A new M49 junction should be linked to the spine road that is being developed through the Central Park development.

11.5 M49 Junction Benefits

11.5.1 South Gloucestershire Council’s evidence suggests that the development of a new M49 junction would provide benefits that include:

- diversion of traffic flows away from other motorway junctions in the area;
- reduced traffic flows in the morning and afternoon peak hours at junctions 18/18A on the M5;
- reduced traffic flows on some of the local routes in the area, including routes to the east of Severnside; and
- improved transport links to the study area that could further enhance the area’s accessibility for storage and distribution uses.

11.5.2 A new junction may also help to attract investment to the area and may provide some enhancement to the land values in the vicinity of the junction (see separate report – Avonmouth Severnside Outline Development Strategy)

11.5.3 The development of a new junction could also serve to provide an additional access to the area to provide a means of escape in the event of the flood risk materialising in the area.

11.6 M49 Junction Cost

11.6.1 Detailed proposals have not been prepared for a new M49 junction. As outlined elsewhere in this report, proposals for a new M49 junction have been carried forward from earlier work that supported the need for a new junction to serve the Avonmouth and Severnside area. The outline proposals for a new junction are now being carried forward in South Gloucestershire’s Core Strategy (see extract from Figure 3 of the Core Strategy below).
11.6.2 South Gloucestershire Council’s Infrastructure Delivery Plan (February 2011) (see: http://www.southglos.gov.uk/NR/rdonlyres/E32CE1D0-9DE9-400A-8CED-3415C4E9373A/0/PTE110068.pdf) states that the cost of a new M49 junction is “unknown”.

11.6.3 However, the cost of providing an M49 junction is included in the West of England Partnership’s Report: Responding to Infrastructure Delivery and Planning Issues in the West of England that was prepared by Roger Tym and Partners in May 2010 (http://www.westofengland.org/planning--housing/reports). The cost is estimated at £42m and it is understood that this sum derives from South Gloucestershire Council’s earlier analysis. This report relies on this cost estimate.

11.6.4 However, in concluding that the earlier cost estimate is appropriate for use in this study, we have investigated the publicised costs of other recently completed and planned new motorway junctions in England. Our research identified a number of other new, proposed or recently completed motorway junctions:

- a new junction 10a on the M20 near Ashford has been costed at £66m to £90m although this has a double over bridge and a higher specification than would be required at Avonmouth and a significant dualled approach
A new junction 29a serving Markham Vale in Derbyshire was implemented in 2007 and its cost has been reported as approximately £20m. This is a lower key junction than is likely to be required at Avonmouth that provided new slip roads to link to existing bridges under and over the M1; and

- a new junction on the M275 at Tipner in Portsmouth is proposed at a cost of £45m (including a park and ride facility and priority bus lane and an allowance for optimism bias), but this does not include an overbridge and will use the existing bridges and part developed slip roads that were developed some time ago.

These schemes broadly support the cost estimate in Roger Tym and Partners report of 2010 and we have therefore relied on it in this study. We have assumed that this cost includes a contribution towards the cost of providing the new link roads that would be necessary to serve the junction (these costs could vary depending on the detailed scale, design and location of these roads).

A further detailed review of the options for locating the new junction and alternative design solutions, or solutions that take advantage of existing routes in proximity to the M49 may reveal alternative lower (or higher) cost solutions than have been identified in published documents to date. Further detailed work will be required to verify the £42m cost estimate in the event that proposals for a new M49 junction are taken forward.

A more detailed review of the options for a new M49 junction will need to take into account the work undertaken by Severnside Distribution Land Ltd in developing a spine road through their land holding in the Severnside area that now extends in a southerly direction in proximity to the LNG plant (see paragraph 11.4.4 and http://www.centralparkbristol.co.uk/news/site-progress-august-2011/).

Although current development plan policies set out the need for a new M49 junction to serve the planned growth in the study area, the Joint Local Transport Plan 3 (that was published in March 2011: http://travelplus.org.uk/media/205985/jltp3%20march%202011.pdf) does not include proposals for a new M49 junction to support the current and emerging development plan policies in the period to 2026.

### 11.7 Other Transport Improvements

#### Highway Improvements

11.7.1 Paragraphs 11.4.4. to 11.4.6 above highlight the ongoing highway developments through the area covered by the 57/58 permission.

11.7.2 Other highway improvements in the area have been identified through, and would be funded by, s106 agreements for development in the study area, including improvements to the junction of Kings Weston Road and St Andrews Road and the Rhodia site access.

11.7.3 It may be necessary to secure other minor highway improvements throughout the study area as a result of specific development proposals, but this study assumes that these would be investigated
and developed on a site by site basis in the context of specific development proposals. We have assumed that the costs of any such improvements would be met by the developers of the sites that they would serve.

**Traffic Management**

11.7.4 Traffic management on the roads leading to the study area from the east has been identified by South Gloucestershire Council as an area where improvements are required to mitigate the impacts of traffic living in communities along those routes.

11.7.5 In the absence of more detailed proposals for the development of such a scheme, it is not possible to provide an indication of the cost of any such proposals. However, where it is able, South Gloucestershire Council is currently seeking s106 contributions from developers in the Severnside area towards off site traffic management measures. South Gloucestershire Council has most recently sought such a contribution (of £0.2 million) from the developer of a 40 ha site in its area ([http://developments.southglos.gov.uk/online-applications/applicationDetails.do?activeTab=documents&keyVal=L9T8PZOK2P0](http://developments.southglos.gov.uk/online-applications/applicationDetails.do?activeTab=documents&keyVal=L9T8PZOK2P0)). We anticipate that both Councils will continue to seek s106 contributions towards off site transport management measures that are required to mitigate the impacts of specific development proposals on the highway network in the area (although the ability to achieve this in the areas covered by the 57/58 permissions will be limited).

**Cycling and Walking**

11.7.6 There is a network of existing cycling and walking routes within the study area. Although it would be possible to develop new cycle and walking routes throughout the area, due to the layout, nature of uses that exist (and that are likely to be developed in the future), shift patterns and distance from residential communities, it is unlikely that walking or cycling will make a significant impact upon the car based nature of trips to and from the study area.

11.7.7 It is anticipated that where such facilities are required to mitigate the impact of specific development proposals within the study area, the Councils will seek s106 contributions towards such measures and will promote them via travel plans. Furthermore, where routes need to be reserved through development sites, we anticipate that these could be secured through planning conditions and s106 obligations. The ability to secure this transport infrastructure will however be limited within the area covered by the 57/58 permissions.

**Public Transport**

11.7.8 Public transport within the study area includes buses and trains. The existing bus services are generally restricted to the northern and southern developed parts of the area. Existing passenger train services are restricted to the Severn Beach line that has stations within the study area at Avonmouth, St Andrews Road and Severn Beach. The existing passenger train line is connected to Bristol Temple Meads.

11.7.9 It is highly unlikely that bus services would operate successfully on a commercial basis within the Avonmouth/Severnside area due to the low density of employment, difficult shift patterns and difficulty of a bus route to be located within a reasonable walking distance of centres of employment.
11.7.10 Future development within the area is likely to be at a similarly low density to the existing development and is unlikely to make public transport significantly more viable in the period to 2050.

11.7.11 However, there is some potential for travel planning to reduce single occupancy car travel to and from the area by increasing the opportunity for car sharing. The opportunities for car sharing could be promoted as part of an area wide travel planning initiative. As a result of such an initiative, opportunities for enhancing public transport provision may become evident.

**Rail Passengers**

11.7.12 The Severnside Community Rail Partnership’s Progress Report of January 2011 ([http://travelplus.org.uk/media/212461/severnside%20crp%20report%20jan%202011.pdf](http://travelplus.org.uk/media/212461/severnside%20crp%20report%20jan%202011.pdf)) confirms the number of passengers using the stations (both boarding and alighting) on weekdays in the study area in 2008, 2009 and 2010:

<table>
<thead>
<tr>
<th>Station</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severn Beach</td>
<td>107</td>
<td>135</td>
<td>143</td>
</tr>
<tr>
<td>St Andrews Road</td>
<td>19</td>
<td>18</td>
<td>24</td>
</tr>
<tr>
<td>Avonmouth</td>
<td>294</td>
<td>243</td>
<td>323</td>
</tr>
</tbody>
</table>

11.7.13 The figures illustrate the relatively low use made of the train services in the context of the number of employees in the study area.

11.7.14 Although the possibility of providing additional rail stations along the existing railway line in the area exists, additional stations are unlikely to be viable and none are currently proposed within the Local Transport Plan 3 or either Council’s development plan documents (although both the Bristol and South Gloucestershire Core Strategies highlight an opportunity to reintroduce a “local passenger rail service between Avonmouth and Filton (Henbury Loop”).

**Rail Freight**

11.7.15 Bristol Port is currently served by an existing rail freight line. The Great Western Route Utilisation Strategy March 2010 ([http://www.networkrail.co.uk/browse%20documents/rus%20documents/route%20utilisation%20strategies/great%20western/great%20western%20rus.pdf](http://www.networkrail.co.uk/browse%20documents/rus%20documents/route%20utilisation%20strategies/great%20western/great%20western%20rus.pdf)) notes that Avonmouth currently has “limited container movements”, but recognises the growth in rail traffic that could arise from the planned Deep Sea Container Terminal (DSCT) at the Port. However, in granting the Harbour Revision Order for the DSCT, the DfT noted that agreement had been reached with Network Rail that this demand could be accommodated without the provision of significant additional capacity on the existing rail network.

11.7.16 The Port is likely to be the greatest user of the existing freight line in the area and it is therefore unlikely that any substantial upgrade to the existing rail network will be required to accommodate further development elsewhere in the Avonmouth and Severnside area. Investment in rail infrastructure for freight is therefore unlikely to be necessary to serve the area’s further development to 2050.
11.7.17 The other rail freight opportunity in the area arises from the proposals by SITA UK (see section 11.4.5 above) to potentially import and export waste by rail to their planned ERC facility. SITA stated that there was a reasonable prospect of utilising rail before 2026 and that the rail linkage had been one of the key factors which made them purchase this site.

11.7.18 SITA’s planning permission requires a regular review of the viability of developing the rail sidings (including the upgrading the signalling on part of the Severn Beach branch line from a one-train system, reinstating the link from the sidings to the branch line and upgrading the sidings, including the track beds, the rails and siding signalling). It requires that they review the economic viability of transporting waste to the site by rail on a 2 yearly basis.

11.7.19 In the event that viability of transporting waste to the site by rail is proven, this opportunity to increase rail freight activity in the area may come forward in the future.

**Bristol Port**

11.7.20 An Economic Assessment of Bristol Port was undertaken by Roger Tym and Partners on behalf of SWRDA in 2004 ([http://www.southwesteip.co.uk/downloads/documents/20061231182214.pdf](http://www.southwesteip.co.uk/downloads/documents/20061231182214.pdf)). At that time, the study noted the land available for the Port’s expansion was "running out" and noted the need to consider the Port’s requirements for expansion (both within the Avonmouth and Royal Portbury Docks areas).

11.7.21 More recently, the Port has secured the necessary approvals to develop a Deep Sea Container Terminal (DSCT). This facility will be developed beyond the existing land area into the estuary by, inter alia, raising levels and developing a new quayside. The development will be privately funded by the Port.

11.7.22 The extent of the proposed DSCT is shown broadly on the plan at Appendix 8. The completion of the DSCT is likely to place further demand for land within the area for port related development. The precise extent of that demand is unknown.

**11.8 Phasing**

**11.8.1** The key transport infrastructure identified in this study is the development of a new M49 junction. Analysis will be required to establish the point at which further development in the study area would make the development of the M49 essential to mitigate the cumulative transport impacts of development.

**11.8.2** The other transport infrastructure identified in this study is already being developed or will be brought forward in association with the individual developments within the study area.
11.9 **Risks**

11.9.1 The risks in connection with the transport infrastructure are set out below:

<table>
<thead>
<tr>
<th>Risks</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highways Agency objects to development of new motorway junction.</td>
<td>Ensure close consultation with the Highways Agency.</td>
</tr>
<tr>
<td>Cost estimate for motorway junction is inaccurate.</td>
<td>Develop and cost more detailed proposal for motorway junction and link roads and undertake ground investigations.</td>
</tr>
<tr>
<td>Assumptions upon which transport modelling is based vary leading to an under/over statement of the impacts of development on transport infrastructure.</td>
<td>Review assumptions and monitor on-going development in the study area.</td>
</tr>
</tbody>
</table>

11.10 **Conclusions**

11.10.1 The evidence of significant ongoing investment in warehouse and distribution uses within the study area illustrates the area’s continuing attraction for such uses that is at least partly based on its location in proximity to the strategic highway network.

11.10.2 The Councils remain committed to bringing forward a new M49 junction and other transport improvements to enhance the area’s accessibility and to make the area more attractive for business investment.

11.10.3 The Council’s development plans set out proposals to bring forward a new M49 junction based on historic evidence. The cost of developing a new M49 junction has been estimated at £42m, but a thorough review of the options for developing a new junction is now required, taking into account the HSE Inner Consultation Zones and other factors. The review of the options will need to investigate the costs and deliverability of those options and will need to re-examine the earlier evidence that supports the need for the new junction.

11.10.4 Although improvements to encourage walking, cycling and an increased use of public transport in the area are desirable, such improvements are unlikely to significantly change the proportion of employees and visitors travelling to and from the area by car because of the relatively low density of uses, large plot sizes and shift working patterns.

11.10.5 There is however likely to be a requirement to undertake localised improvements on the highway network in the period to 2050, either directly in association with development proposals or to improve existing sub standard junctions.

11.10.6 Further work could be undertaken to assess the opportunity to implement traffic management measures on the rural roads leading to and from the site. However, any such study should be undertaken on a comprehensive basis to ensure that the implications of introducing such measures on specific routes are fully understood and do not result in adverse impact on other routes.
12.0 Flood Risk and Drainage

12.1 Context

12.1.1 The study area is low lying and adjacent to the Severn Estuary with the mouth of the River Avon to the south west. The area is drained by a large network of artificial rhynes and control structures. The Environment Agency’s current flood mapping of the area shows that it is wholly within Flood Zone 3 i.e. the 1 in 200 year tidal floodplain of the Severn Estuary (see plan on following page and at Appendix 18).

12.1.2 The tidal defences that serve the area are sub-standard. Current defences along the estuary provide a variety of standards of protection ranging between 1 in 10 at the Port Lock Gates to 1 in 200. Even though the area is protected by a combination of Environment Agency and privately maintained defences (e.g. Bristol Port) these vary in terms of design and materials. The defences do not therefore provide protection to the required standard (as set out in PPS25) either now or to accommodate the effects of climate change over the lifetime of the development.

12.1.3 The Environment Agency’s recommended standard of protection for new development to be safe from tidal flooding is 1 in 200 years plus an allowance for climate change. The current defences along the sea frontage do not provide this level of protection.

12.1.4 Current climate change predictions indicate a sea level rise of approximately 1m by 2105 that would lead to significant overtopping of the existing defences. In the event of a tidal flood, this would lead (using the DEFRA “Flood Risks to People” flood hazard category system) to “danger for most”/“danger for all” across the area.

12.1.5 It is therefore of vital importance to the existing and planned development in the area that the increasing risks from tidal flooding are mitigated on a strategic basis to help enable sustainable development. In the absence of a strategic solution to the risk of tidal flooding in the area, development in the area is unlikely to be sustainable.

12.2 Market Perception

12.2.1 The majority of the study area is, with the effects of climate change, at an increasing risk of tidal flooding. However, in advance of examining the technical issues, it is worth noting the comments in the Annexes to Bristol City Council’s Employment Land Review (http://www.bristol.gov.uk/sites/default/files/documents/council_and_democracy/statistics_and_census_information/employment-land-study-annexes-to-final-report-Feb09.pdf) that state:

We have been asked to comment on market perceptions of flood risk in Avonmouth/Severnside. At present, despite large areas of Avonmouth and Severnside being within the River Severn flood plain and widely publicised general threats of global warming, rising sea levels and increasing flood risk in such areas, market sentiment is currently not reflecting these concerns. Clearly, should there be a significant flood in this area in the future this would have a dramatic detrimental impact on Bristol’s industrial land provision and there would also be an adverse market reaction to land and buildings in the affected area which is dominated by factories and warehouses.

12.2.2 Although “market sentiment” is not currently reflecting concerns about flood risk in the area, this statement highlights the need to ensure that flood risk in the area is managed to avoid a “dramatic detrimental impact on” Bristol and South Gloucestershire’s “industrial land provision.”
Avonmouth and Severnside Infrastructure Study

Key
- Study Area
- Flood Zone 3a
- Flood Zone 3b (Functional Floodplain)
- Flood Zone 2

Bristol City and South Gloucestershire Councils
Avonmouth and Severnside Study
SFRA Flood Zones 2010

WYG Planning & Design
part of the WYG group

January 2012

Do not scale from this drawing

Scale 1:25,000

1 km

North

WYG Project Number: A066776
February 2012
12.3 Current Approach to Development Management

12.3.1 The Environment Agency and both Councils acting as local planning authorities have to date, notwithstanding the increasing risk to the area from flooding, supported proposals for development within the study area on a case by case basis. The approach taken by the authorities in determining planning applications for development within the area (and the Secretary of State on appeals) has been to:

- review development proposals on a case by case basis;
- acknowledge that planning policies are generally supportive of proposals to redevelop previously developed land for employment development (principally B2, B8 and sui generis uses) within the study area;
- accept that much economic development meets the requirements of the Sequential Test on the basis that there are no alternative sites available that are at a lower risk of flooding in the area;
- accept that employment development is “less vulnerable” and appropriate in Flood Zone 3a; and
- require on site flood mitigation in the form of localised land raising (for example of building footprints and external storage areas) and flood evacuation/emergency plans to mitigate the risks of flooding; and
- require that flood risk assessments demonstrate that development will not increase the risk of flooding elsewhere.

12.3.2 However, the Environment Agency and Councils recognise, in the context of the SFRA 2 that was published in March 2011, that it is not desirable to continue to deal with development proposals in the area on a case by case basis and that a long term, comprehensive, strategic solution is required to reduce the risk of tidal flooding in the area and to enable the area to reach its full potential.

12.3.3 For the purposes of this study, we have assumed that further economic development within the study area is unlikely to be acceptable to the Environment Agency and the Councils in the absence of strategic mitigation for flood risk in the area.

12.4 Surface Water Drainage and Lower Severn Internal Drainage Board

12.4.1 The majority of the study area has specific drainage problems which necessitates its inclusion within the area administered by the Lower Severn Drainage Board. The Board is responsible for administering surface water drainage in the area highlighted in the map below that includes the entire study area.
Surface Water

12.4.2 Development, including proposals for new infrastructure and improvement to the area’s flood defences will need to consider the detailed implications on surface water drainage from the area. Modelling will be required to assess the implications of climate change and sea level rise on surface water drainage in the area in the context of the full development of the 57/58 permissions.
12.4.3 The Board’s Guide for Development Within the Avonmouth/Severnside Area Draft Strategy states that it will levy an infrastructure charge of £25k per hectare of new development within the study area (with a reduction for work undertaken in kind that is of benefit to others in the catchment area). This charge is applied to all new development, but excludes development that benefits from the 57/58 permissions.

12.4.4 The Board will enter into maintenance agreements for the adoption of strategic ponds and rhynes in the area. Such agreements include commuted sums for maintenance that are calculated by the Board.

12.4.5 The costs identified above are common to and applicable across the whole study area and are therefore likely to be reflected in land values in the area.

12.5 Flood Risk

12.5.1 The study area is adjacent to the Severn Estuary and much of it is relatively low lying and at risk of flooding. Although the area is partially protected from the risk of tidal flooding by existing sea defences, many of these defences have not been developed and are not maintained formally as flood defences.

12.5.2 The Project Brief requires that we “establish what is required to "hold the line" in terms of flood defence?” “Hold the line” broadly refers to the policy of maintaining the existing flood defences and control structures in their present positions, and increasing the standard of protection against flooding in some areas.

12.5.3 The draft Severn Estuary Shoreline Management Plan 2 (SMP2) states that the short term (0-20 years) policy adopted in relation to the flood defences in the area is “hold the line”. The “hold the line” position will however change with time as sea levels are predicted to rise to 2050 and beyond.

12.5.4 The study area is at increasing risk of tidal flooding with climate change. Parts of the study area are also at risk of fluvial flooding, but the greatest risk to existing development in the majority of the study area arises from tidal flooding.

12.5.5 The Councils commissioned SFRA to inform their local development frameworks and individual development proposals that continue to come forward within the study area. The Councils, together with the Lower Severn Drainage Board, published the SFRA 2 - Avonmouth/Severnside Summary Report in March 2011. This and the current SMP provide the principal evidence in respect of flood risk that informs this report.

12.5.6 Planning policies seek to direct new development to areas at least risk of flooding. If further development is to be accommodated within the study area, it is essential that decisions about the scale, location and nature of that development are taken in the context of an analysis of the risks of flooding and the options for mitigating these.

12.5.7 This Report is accompanied by a Flood Risk Management Study prepared by Buro Happold at Appendix 6. The Study was prepared to specifically examine the flood risks within the study area.
and options for mitigating those risks to better protect existing development and facilitate further economic development within the study area to help the area achieve its full potential.

12.6 **Strategic Flood Risk Assessment – Level 1**

12.6.1 The Councils have separately commissioned Strategic Flood Risk Assessments - Level 1 (SFRA 1) for their areas in accordance with guidance in PPS 25 – Development and Flood Risk. Bristol’s SFRA 1 is available at:

http://www.bristol.gov.uk/sites/default/files/assets/documents/Bristol%20City%20Level%201%20Final.pdf

and South Gloucestershire’s is available at:


12.6.2 The SFRA 1 were prepared to inform the preparation of development plan policies, particularly those that relate to flood risk and the allocation of land for development, including each Council’s Core Strategy and Site Allocations Development Plan Documents. Each SFRA 1 covered the whole of each Council’s area and did not therefore focus specifically on the Avonmouth/Severnside area.

12.6.3 The SFRA 1 have been used to inform Sustainability Appraisals that have examined different development and growth options in each Councils area and, in particular, whether it is possible to accommodate all development requirements within areas with a low probability of flooding.

12.6.4 In the event that it is not possible to accommodate all development in areas at a low probability of flooding, the SFRA 1 are used to inform the “Sequential Test” that is required to assess the suitability of development in areas at higher risk of flooding, such as the study area.

12.6.5 South Gloucestershire Council’s SFRA 1 recommends that:

“For the continued development of Avonmouth/Severnside, a strategy to provide improvements to existing infrastructure to accommodate growth is recommended. This may incorporate the improvement and maintenance of existing flood defences.”

12.7 **Strategic Flood Risk Assessment – Level 2 (SFRA 2)**

12.7.1 Each Council’s SFRA 1 identified the need for an SFRA 2 for the Avonmouth/Severnside area.

12.7.2 Bristol City Council also commissioned a Citywide SFRA 2 (available at: http://www.bristol.gov.uk/page/strategic-flood-risk-assessment-sfra) that examined flood risk in the Avonmouth area and recommended that flood defences in the area be raised and extended to reduce the flood risk and mitigate climate change impacts in the area. It recommended that the options for doing this be the subject of a separate study (the SFRA for the Avonmouth and Severnside area).

12.7.3 The Councils and the Lower Severn Drainage Board commissioned the SFRA 2 for this coastal area. The SFRA 2 covers a wider area than the current study by including land to the north and east. A summary of the SFRA 2 is available at:

12.7.4 The SFRA 2 provides a more detailed assessment of flood risk issues in the Avonmouth and Severnside area to enable the Councils to assess flood risk in increasing detail as they progress their LDF and consider the allocation of land for development within the area.

12.7.5 The main objectives of the SFRA 2 are to provide flood information:

- so that an evidence based and risk based sequential approach can be adopted when making planning decisions, in line with PPS 25;
- that is strategic in that it covers a wide spatial area and looks at flood risk today and in the future;
- that supports sustainability appraisals of local development frameworks;
- that identifies what further investigations may be required in flood risk assessments for specific development proposals.

12.7.6 The SFRA 2 notes that the Environment Agency has advised that any future development should take full account of flood risk and be based on the appropriate application of the risk-based sequential approach advocated in Planning Policy Statement 25 – Development and Flood Risk (PPS25):


12.7.7 The SFRA 2 results indicate that the level of protection provided by the existing tidal defences is likely to reduce significantly in the future due to the effects of climate change, principally increases in sea level and increased 'storminess' and wave overtopping. If defences are not improved, the frequency and severity of flooding in the future is such that existing and planned development is unlikely to be sustainable. The SFRA 2 findings demonstrate that there is a need to upgrade the defences (both condition and design standard) and maintain them in the future to sustain development in the area.

12.7.8 The SFRA 2 Summary Report notes in particular at paragraph 9.52:

*Improvements to defences are considered essential for the Avonmouth/Severnside area to remain viable in the future given the scale of future flooding expected due to climate change.*

12.8 Severn Estuary Flood Risk Management Strategy (SFRMS) - Managing Flood Risk on the Severn Estuary (January 2011)

12.8.1 On a broader scale, the Environment Agency consulted on its emerging SFRMS in January 2011. The consultation covers the area in this study. The aim of the Strategy is to identify how the EA can best manage flood risk in the area over the next century. An extract from the consultation document is attached at Appendix 19.
12.8.2 One of the principal concerns raised during the consultation was the proposal to allocate areas of
farmland for the creation of inter-tidal habitat to maintain a balance of wildlife habitat within the
estuary. The Agency is now refining its approach and hopes to reduce the area of land required for
inter-tidal habitat and to work with landowners to create that habitat.

12.8.3 The consultation document notes that although the typical chance of flooding in the area is 1 in 100,
locally the risk can be 1 in 20 (although the standard of protection is as low as 1 in 10 at the Port
Lock Gates (see paragraph 13.1.2). This is well below the Environment Agency’s recommended
standard of protection for new development to be safe from tidal flooding (1 in 200 years plus an
allowance for climate change (see Appendix 5)). It notes that, in the future, as sea levels and
storminess increase, the level of flood risk in the area will increase. After 2030, works will be
required to the raise the existing defences to keep pace with climate change and if the defences are
not improved after 2060, there is a risk of annual tidal flooding.

12.8.4 The existing defences will therefore need to be increased in height to bring them up to the 1 in 200
year standard of protection today, and will either needed to be further increased in height in the
future, or future proofed with an increased height today, to take account of climate change.

12.8.5 The Strategic Environmental Assessment accompanying the consultation suggests that the nature
conservation sites that are seaward of the flood defences may be adversely impacted by the
increased footprint that would be required from the raising of the flood defences. The seaward areas
will, assuming that the existing defences are maintained, be the subject of “coastal squeeze” as sea
levels rise and the habitats become eroded. It therefore concludes that the additional impact over
and above that which will arise from climate change and increasing sea levels is unlikely to be
“significant”.

12.8.6 The consultation documents also note that the existing flood defences in the area are contributing to
some habitat loss because they stop the estuary naturally adjusting its shape as sea levels rise. It
suggests that the Government is legally obliged to put back the habitat that is lost from this process
and that without the habitat being replaced, it may be necessary to stop maintaining or improving
the flood defences.

12.8.7 This study has not examined the implications (legal and technical) of maintaining or raising the
existing tidal defences to the west of the existing flood defences. The impact of maintaining (or improving) the existing flood defence on these habitats will require further
investigation – both from a technical and legal perspective. The implications arising from the
Environment Agency’s consultation documents could be significant. It is however unlikely that they
could be resolved within the study area alone and would therefore need to be addressed through
the wider Management Strategy for the Estuary.

12.8.8 For the purposes of this study, we have assumed that the impacts of maintaining or raising the flood
defences (to reduce the risk of flooding in the study area) on the ecology of the estuary to the west
of the defences will be resolved via an approach that considers the Estuary as a whole and that the
costs of delivering the wider SFRMS will be met separately.

12.9 Tidal Flood Risk

12.9.1 Strategically, the biggest factor influencing flood risk in the area is the tide levels in the Severn
Estuary. The SFRA 2 confirms that the majority of the study area is now in 2011, and will remain in
2111, within Flood Zones 3a and 3b (the functional flood plain).
12.9.2 Although this study is intended to focus on the period from the present to 2050, the pattern of development that is established between now and 2050 is likely to exist well beyond that period and, in flood risk terms, it is important to plan development taking into account the predicted changes in sea level over a longer period, notwithstanding that some development within the study area may have a shorter lifespan.

12.10 Fluvial Flood Risk

12.10.1 It is also important to note that significant parts of the study area are also at risk from fluvial flooding. The areas at risk of such flooding are shown on the plan at Appendix 18 as being within Flood Zone 3b (the functional flood plain).

12.11 Implications for the Study Area

12.11.1 Existing and planned development within much of the study area, including important infrastructure, is at an increasing risk of tidal flooding as a result of climate change. The existing flood defences within the study area will become increasingly inadequate to defend the area against the risk of tidal flooding in the period to 2111.

12.11.2 The existing tidal flood defences are in a number of different ownerships, of variable quality and height and comprise a mix of formal and informal (e.g. the existing railway line) structures. At present there is no formal regime in place for maintaining or improving the existing flood defences.

12.11.3 The Port is intending to develop its DSCT at a height of 10.67m OD and this will act as a flood defence in the south west corner of the study area. However, the Port is not, as part of its proposals to develop the DSCT, intending to replace the lock gates that will remain at a substantially lower level.

12.11.4 Although improvements to the flood defences, or the provision of a new flood defence, could be undertaken on a phased basis, the level of protection offered by the defences will only be as high as the lowest or weakest length of the defences.

12.12 Site by Site Mitigation

12.12.1 Within the study area, the approach to mitigating the increasing risk of flooding to new development has, to date, generally been addressed on a site by site basis with land raising taking place within individual development sites to mitigate the risk of tidal flooding. However, such an approach may, in the longer term, be unsustainable because, in the absence of other measures, it is likely to potentially increase the risk and depth of flooding to other development in the area.

12.12.2 Developers of land within the area of the 57/58 permissions have been raising land levels to mitigate the risk of tidal and fluvial flooding. South Gloucestershire Council is unable to exert any planning or other controls over the development, including the raising of land levels, within the area covered by those permissions.

12.12.3 The area covered by the 57/58 permissions is not yet fully developed. The continued raising of land is likely to increase the impact of flooding on other development within the study area. The SFRA 2 indicates that if the entire area covered by those permissions were developed with raised land levels, the depth of flooding across the remainder of the study area could increase by up to 0.3 metres.
12.12.4 However, land raising is also taking place outside the area covered by the 57/58 permissions with two substantial, recent developments (an energy from waste plant for SITA in the Severnside area and the development of a new distribution warehouse for the Co-op in Avonmouth) on previously developed land being granted planning permissions for new developments, subject to buildings and other important external areas being raised so that their finished floor levels will be at a lower risk of flooding in the future.

12.12.5 In the context of the findings in the SFRA 2, the ongoing raising of land levels across the study area is unlikely to be sustainable in the longer term because of the impact on potential flood levels elsewhere in the study area. However, there may still be a need to develop new buildings with elevated floor levels to mitigate the residual risks from flooding even with a strategic defence solution in place.

12.12.6 Both Councils’ desire to realise the Vision in the study area means that it is necessary to consider whether additional land could be brought forward for economic development in the study area. It is therefore necessary to consider how additional development (on both previously developed and green field land) could be brought forward in the context of the fluvial and tidal flood risks in the area and the opportunity to develop a strategic solution to mitigate the risk of tidal flooding in the area.

12.13 Functional Flood Plain – Flood Zone 3b

12.13.1 Some parts of the study area are within the functional flood plain (Flood Zone 3b). Development in such areas should be restricted to “water compatible development” and “essential infrastructure” (including essential transport infrastructure and utilities that need to be located in such areas) that does not adversely affect flood flows and mechanisms.

12.13.2 The extent of the land within Flood Zone 3b is shown in the plan at Appendix 18. The areas of functional flood plain include:

- a substantial area of green field land within the central undeveloped part of the study area;
- substantial parts of the undeveloped area covered by the 57/58 permission (illustrated in the photographs from the year 2000 that were included in the SFRA 2); and
- much of the green field land in the Avonmouth area in proximity to the M5/M49 junction.

12.13.3 Economic development within the functional floodplain would not normally be acceptable. We have therefore generally sought to exclude such areas from our assessment of the area’s economic development potential. In particular, we have assumed that the green field land to the south of the railway line within the Avonmouth area that is part of the functional floodplain will not be suitable for economic development (see extract from the plan at Appendix 10 below that shows these areas cross hatched blue):
Furthermore, no studies have been undertaken to assess the implications of the 57/58 permissions being completed within the functional floodplain. There is a risk that the development of the 57/58 permissions will displace water elsewhere within the study area in the event of a fluvial flood. Further work will be required to assess the implications of the displacement of the functional floodplain and whether this could increase the risk of flooding elsewhere within the study area. Broad assessments of the implications of land raising are however available in the SFRA 2 for the Avonmouth/Severnside area.

However, much of the undeveloped, central part of the study area is at a similar level and has a relatively flat topography. Depending on the outcome of further work to assess the implications on fluvial flood risk of the development of the land covered by the 57/58 permissions, it may be possible to mitigate the risk of fluvial flooding in some areas by lowering land levels in neighbouring parts of the study area. We have assumed that this approach would, from a flood risk perspective, enable the development of some of the land within the central part of the study area.

**12.14 Sequential Test**

Outside Flood Zone 3b, the majority of the study area is within Flood Zone 3a. Even if the existing flood defences were increased in height to better protect the study area against the risk of tidal flooding, the areas that are currently within Flood Zone 3a would remain so because of the risk of a breach, even after the completion of those defences. In such areas, PPS 25 advocates a sequential approach to assessing flood risk.
12.14.2 PPS25 advises that decisions to allocate land in development plans and decisions on planning applications for industrial and warehouse development should pass the "Sequential Test" i.e. demonstrate that there are no other "reasonably available" sites for such development in areas with a lower risk of flooding.

12.14.3 The SFRA 2 will be the key tool that is used by the Councils to assess allocations for new development sites in the study area using the Sequential Test and (where necessary) Exception Test as required by PPS 25.


12.14.5 The Sequential Test should be applied when allocating land for development in development plan documents. The Test is applied to demonstrate that there are no reasonably available sites in areas with a lower probability of flooding, which would be appropriate to that type of development.

12.14.6 If there is no other reasonably available site within the lowest risk zone (from all sources of flooding), then the vulnerability of the proposed development can be taken into account. Industrial and warehousing developments generally fall into the lower vulnerability classifications of land use that could, if they meet the "sequential test", be acceptable from a flood risk perspective in Flood Zone 3a.

**Approach to the Sequential Test to Date**

12.14.7 Development of the land covered by the 57/58 permissions has progressed without the need to address the Sequential Test. On sites that are not covered by these permissions, the Councils and Environment Agency have accepted that, to date, the development of large scale industrial and warehouse premises and waste processing facilities on sites allocated for such development meet the Sequential Test.

12.14.8 The Councils have also allocated (predominantly previously developed) sites for residual waste treatment facilities within the study area through the JWCS on the basis that there are no other suitable sites available that are at a lower risk of flooding within their areas, and that there is a reasonable prospect of developers of these facilities being able to demonstrate that the risk of them flooding can be addressed without materially increasing the risk of flooding elsewhere in the area.

**Reasonably Available Sites at a Lower Risk of Flooding?**

12.14.9 In considering whether there are any reasonably available sites at a lower risk of flooding, it is necessary to define a geographical area of search. The Environment Agency’s guidance about the application of the Sequential Test notes that the area will usually be the whole of a local planning authority’s area. It does however also note that the area could in some cases be reduced or increased (for example in the case of a new oil refinery where the area of search might include the whole country).

12.14.10 The PPS25 Good Practice Guidance notes that local planning authorities should consider undertaking such an assessment at a sub-regional level to broaden the scope for opportunities to
reduce flood risk and put the more vulnerable development in lower flood risk areas. It also acknowledges that development may be needed in Flood Zones 2 and 3 for sustainability reasons.

12.14.11 The Councils will, through the development plan process, consider the need to allocate additional land for industrial and warehousing development within their boundaries beyond the period covered by their Core Strategies to 2050. If the Councils are able to demonstrate that there is no other land at a lower risk of flooding that is suitable for such development to 2050, the land within the study area will have “passed” the Sequential Test.

12.14.12 Bristol City Council’s area only has limited land within it and there are few opportunities to allocate additional land to accommodate further industrial and warehouse development. However, South Gloucestershire includes substantial areas of land outside Flood Zone 3a and in Flood Zones 1 and 2 that may be suitable for such development.

12.14.13 Within the context of this study, it is not however possible to demonstrate that, in general terms, industrial and warehousing development could not be allocated on land within each Council’s area (or over a wider area) that is at a lower risk of flooding (i.e. in Flood Zones 1 and 2).

12.14.14 However, for the purposes of this study, we have assumed that there is no other land available in the “area” for general industrial and warehousing development that is at a lower risk of flooding (i.e. in Flood Zones 1 and 2).

12.14.15 In the event that other suitable land for industrial and warehouse development is available outside the study area within Flood Zones 1 or 2, the development of land for such purposes within the study area would fail the Sequential Test and would not accord with current planning policies about development and flood risk.

12.14.16 Although this applies to the general allocation of land for industrial and warehouse development, there may be a need for land to be allocated in proximity to the Port for related uses or because of the area’s good links to the strategic road network. Furthermore, we have already acknowledged that the study area is of at least regional importance and that much new development has taken place within the area because of its specific location characteristics that include proximity to the motorway network and the Port. It is unlikely to be possible to identify land that is suitable for such development within an area that is at lower risk of flooding. The allocation of land for industrial and warehouse development that has specific location requirements that could only be satisfied by land within the study area could therefore “pass” the Sequential Test.

**12.15 Exception Test**

12.15.1 Industrial and warehousing development within the study area would be classed as “Less Vulnerable” and would not, if the Sequential Test were satisfied, normally need to address the Exception Test.

**Breach Hazard Bandwidth and Exception Test**

12.15.2 However, within the study area, the SFRA 2 identifies a “breach hazard bandwidth” where it is recommended that new development within the “less vulnerable” category (that includes industrial and warehousing and distribution development) should also pass the Exception Test.

12.15.3 Due to the potentially high flood hazard posed by a breach in the tidal flood defences in the area, the breach hazard bandwidth has been identified as an additional Flood Zone. This area is where
particularly high velocities and speed of inundation would be expected in the event of a breach in those defences. The area extends across a significant strip almost 2kms wide inland from the shoreline, encompassing a significant part of the study area (see plan at Appendix 20). It identifies the "residual risk" from flooding in the study area in the event that the existing flood defences (or future improved defences) were to fail.

12.15.4 The risk of the flood defences failing would also need to be addressed by the introduction of a comprehensive management plan that seeks to ensure the proper management and maintenance of all of the flood defences that protect the area.

12.15.5 The SFRA 2 recommends an extended Flood Zone 3a policy for the breach hazard bandwidth and a requirement for development to satisfy the Exception Test. It also recommends that FRA for development in this area should assess the risk of breach in more detail and consider mitigation measures, including building design. The development of new buildings within this area may therefore be more costly than for a "standard" building type.

12.15.6 The Exception Test seeks to ensure that new developments which are needed in medium or high flood risk areas only occur where the flood risk is outweighed by other sustainability factors and the development can be made safe for its lifetime, taking climate change into account.

12.15.7 The Exception Test is broadly that:

- it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by an SFRA where one has been prepared;
- the development should be on developable previously-developed land or, if it is on green field land, that there are no reasonable alternative sites on developable previously-developed land; and
- a FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere.

12.15.8 We have assumed that the SFRA 2 requirement for development within the "breach hazard bandwidth" to pass the Exception Test would remain, even following the development of a strategic flood risk solution. However, the risk of a breach could be reduced by the implementation of a robust management and maintenance regime.

12.15.9 It is therefore important to consider the possibility of development within the breach hazard bandwidth within the study area on the basis of the need to pass the Exception Test.

12.15.10 In this context:

- the development of land within the study area could provide wider sustainability benefits to the community by supporting economic development. The sustainability benefits of developing within this area would need to be set out in a Sustainability Appraisal;
- the development of green field land within the study area should only be brought forward after the development of previously developed land has been exhausted; and
- an FRA is able to demonstrate that the development of such land could be made safe and that it would not increase flood risk elsewhere.
12.15.11 The requirement to pass this Test would therefore exclude the possibility of industrial and warehouse development on green field sites within the study area, until such time as “developable previously developed” sites have been exhausted. In the context of the substantial areas of previously developed land within the study area, the development of further green field land within the breach hazard bandwidth area is unlikely to be justified at the present time, but may become justified as the supply of previously developed land available for development diminishes.

12.16 Flood Risk Assessments

12.16.1 Proposals for new development in the area will need to be accompanied by Flood Risk Assessments (FRA) that demonstrate that development itself could be safe and that it would not increase the risk of flooding elsewhere. It is likely that individual developments would still need to incorporate proposals for raised land areas to provide safe refuges and/or opportunities for the safe means of escape from such sites in the event of the flood risk materialising. Although further land raising would to some extent put existing properties at lower levels at increased risk, this approach is likely to be required to mitigate the risks of flooding within the breach hazard bandwidth area.

12.16.2 It will be important to ensure that raised areas, including means of escape, do not adversely affect flood flows across the area or exacerbate the risk of flooding to other areas.

12.16.3 The possible impacts of new or improved means of escape and transport infrastructure will need to be carefully considered and, if possible, mitigated through design (for example, through the provision of flood culverts or viaduct structures).

12.16.4 Where engineering or cost constraints are prohibitive, it may not be possible to provide a safe means of egress during a large tidal flood event. The effectiveness of flood warning and appropriate emergency plans, including refuge areas, will therefore be crucial.

12.17 Flood Risk Mitigation Options

12.17.1 The principal flood risk mitigation options are to:

- do nothing;
- implement strategic land raising across the study area on a site by site basis to ensure that development is above the predicted flood levels;
- implement a strategic flood defence by
  - raising the height of the existing defence along the study area’s southern and eastern boundaries to 10.74m OD; or
  - raising the height of the existing defence along the study area’s southern and eastern boundaries to 12.74m OD; or
  - developing a new flood defence to the east of the existing flood defence to 10.74m OD; or
  - developing a new flood defence to the east of the existing flood defence to 12.74m OD;

alongside measures to ensure that development is safe in the event of a breach, or, in the case of the 10.74m OD option, wave overtopping (for example, localised land raising). The levels of 10.74m and 12.74m AOD have been selected from the analysis in the SFRA 2.
Do Nothing

12.17.2 The SFRA 2 indicates that it is essential that a strategic flood defence solution is brought forward to protect existing development within the study area. The “do nothing” option is not therefore acceptable because existing development and infrastructure within the study area would become increasingly at risk of tidal flooding. This option would also preclude new development within the study area as it becomes subject to an increasing risk of flooding.

Strategic Land Raising

12.17.3 The SFRA 2 concludes that the strategic raising of land levels within the study area is likely to increase the risk and severity of flooding for others. This has been the approach of developers of green field and previously developed land to date, but the Environment Agency has stated (see Appendix 5) that:

As the Agency is the Councils’ flood risk advisor, it will need to make a clear representation to both LPA’s about the risks and implications of continuing a site specific approach. It must be understood that it is not a sustainable approach as the cumulative impact of land raising, as explained in the Phase 4 SFRA, has a detrimental impact due to a loss in overtopping storage volume, creating an increased risk in flooding to third parties. The risk of breach would also still be present. To summarise, this approach is unacceptable and contrary to government policy, as detailed in PPS25.

12.17.4 We have therefore assumed that, in general, a site specific approach to development on both green field and previously developed land within the study area will no longer be acceptable and that a strategic solution will be required to enable further economic development in the study area.

Implement a Strategic Flood Defence

12.17.5 The implementation of a strategic flood risk solution across the study area is the recommended way forward.

12.17.6 The SFRA 2 notes that the development of a new strategic flood defence to a height of 12.74m OD that would protect the area against overtopping from extreme tidal waves in the Severn Estuary would be prohibitively expensive (£200–300 million) and is unlikely to be acceptable on environmental grounds. This option is not therefore acceptable.

12.17.7 Although there may be some opportunities or requirements to develop parts of a strategic flood defence to the east of the existing defences, the development of an entirely new defence to the east of the existing been excluded from further analysis in this study because such an approach would:

- leave the railway infrastructure vulnerable to flooding;
- leave other development and infrastructure to the east of any such defence still vulnerable to flooding;
- have an impact on other drainage within the area; and
- require the demolition and removal of existing development and infrastructure.

12.17.8 The main option considered in this study is therefore the improvement of the existing flood defence (with potential new sections of defence being constructed in some areas) to a height of 10.74m OD. The SFRA 2 selected this level as an indicative design level solely for the flood defence assessment. It broadly represents a 1 in 200 year level of protection, taking into account climate change and...
assuming a still tide level with a 0.5m “freeboard” (and excluding the unknown risks of wave overtopping and a breach in the defences).

12.17.9 Although there has been no specific assessment of the standard of protection (SoP) that this level would provide, we have assumed that this would represent a “Hold the Line” solution.

12.17.10 However, this solution would not eliminate all flood risk within the area. There would still be some risk from wave overtopping, larger tidal flood levels, breach, and fluvial flooding. In particular, the increased height of the defence would not affect the Environment Agency’s designation of much of the study area within Flood Zones 3a (because the mapping assumes a possibility of a breach in the defences) and 3b and would not alter the breach hazard bandwidth identified in the SFRA 2. There would therefore still be a requirement for new development to 2050 to address the Sequential Test and the Exception Test where it fell within the area of the breach hazard bandwidth.

12.17.11 A more detailed assessment of residual risk associated with wave overtopping will be required and an assessment of the benefits of the flood defence solution will need to consider the reduction rather than the removal of residual flood risk. If the frequency and severity of flooding to the study area were reduced from what might otherwise occur due to climate change, it would improve the sustainability of existing development in the area and would also improve the sustainability of any additional development.

12.18 Costs

12.18.1 The SFRA 2 estimates the cost of raising the existing defences to a minimum level of 10.74m AOD as £56.8 million, including works to the Port’s lock gates and tie in structures.

12.18.2 Buro Happold have also indicated in their study that a contingency sum of £3m should be included for works that may be required to mitigate fluvial flood risk within the study area.

12.19 Phasing

12.19.1 Although phasing of the flood defence work is possible and likely to be desirable given the multiple ownerships and nature of the different lengths of defence, the completion of improvements to the entire flood defence is necessary to “hold the line” whilst keeping pace with climate change.

12.19.2 Indeed, the Environment Agency note in their letter of the 22nd March 2011 (Appendix 5) that:

> Flood protection would need to be provided for the whole tidal cell rather than just partial improvements. ... a strategic flood risk management approach is required to enable new development. The preferred approach is to improve the tidal defences.

12.19.3 A phased approach to raising some of parts of the defences to keep pace with climate change may be possible, The Environment Agency has commented that:

> “It is doubtful whether the length of defence could be delivered in a phased manner, on the grounds that it would still get flanked from low spots. However, it may be possible to provide the final design height in a phased approach, thereby ensuring the provision of an appropriate defence when it is actually needed. Detailed design would need to investigate the phased approach, particularly in respect of the inherent costing implications.

12.19.4 It is likely that a phased approach to the development of the defences would be significantly more expensive and in the case of some areas (including the railway line), it is unlikely to be feasible.
Instead, each section will need to be raised to the required height of 10.74m OD in a single operation.

12.19.5 In the context of the requirement to undertake further work to, inter alia:

- assess the implications of maintaining and raising the flood defences on the SPA tidal habitat to the west of the flood defences;
- assess the proposals under EIA and the Habitat Regulations;
- assess the condition and method of construction of the existing defences;
- prepared detailed designs for the proposed works; and
- procure the works;

it is likely to take a minimum of 5 to 10 years to bring forward a comprehensive flood risk solution (i.e. 2016 to 2021).

12.19.6 Planning policy in respect of the development of green field land within the study area is unlikely to support such development until it has been established that a comprehensive flood risk solution is likely to come forward.

12.20 Risks

12.20.1 The risks associated with the area’s potential for tidal and fluvial flooding are significant.

<table>
<thead>
<tr>
<th>Risks</th>
<th>Mitigation</th>
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<tbody>
<tr>
<td>Maintenance/raising of the existing flood defences results in a loss of habitat that must be mitigated elsewhere.</td>
<td>Seek technical advice about the impact of climate change on the SPA in the event that flood defences are maintained at, or raised above, their existing height.</td>
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<tr>
<td>Landowners are unwilling to co-operate to develop a comprehensive flood risk solution.</td>
<td>Consider CPO powers and alternative comprehensive flood risk solutions.</td>
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<tr>
<td>Existing flood defences are incapable of improvement.</td>
<td>Consider options to replace existing flood defences or develop new flood defence inland.</td>
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<tr>
<td>Condition of flood defences is worse than anticipated and more urgent works are required to maintain/raise the defences.</td>
<td>Undertake more detailed condition surveys of the defences.</td>
</tr>
<tr>
<td>Assumptions underlying cost estimate vary resulting in variation in cost.</td>
<td>Seek to verify cost assumptions, particularly costs of improving the railway line.</td>
</tr>
<tr>
<td>Options for flood mitigation have a significant harmful impact on the SPA.</td>
<td>Consider alternative options for design and siting of flood defences.</td>
</tr>
<tr>
<td>Flood risk mitigation measures do not provide</td>
<td></td>
</tr>
<tr>
<td>Issue</td>
<td>Recommendation</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Adequate protection to bring forward the development of land for development.</td>
<td>Ensure proposals for bringing forward land comprehensive flood risk solution are pursued.</td>
</tr>
<tr>
<td>Investors/developers take an increasingly risk averse view to development within the study area.</td>
<td>Consider alternative flood defence options in the vicinity of the Port.</td>
</tr>
<tr>
<td>Bristol Port delays/abandons its proposals for a DSTC.</td>
<td>Undertake technical work to assess impact of development of 57/58 permission on fluvial flood risk in the area.</td>
</tr>
<tr>
<td>Fluvial flooding is exacerbated by the development of the 57/58 permission.</td>
<td>Exclude areas in Flood Zone 3b from further consideration for development.</td>
</tr>
<tr>
<td>Fluvial flood risk can not be mitigated.</td>
<td>Undertake detailed analysis of fluvial flood risk mitigation.</td>
</tr>
<tr>
<td>Fluvial flood risk mitigation is too costly.</td>
<td>Consider cost of acquiring and subsequent management of land for flood risk mitigation.</td>
</tr>
<tr>
<td>Fluvial flood risk mitigation is incompatible with ongoing agricultural use of the land.</td>
<td>Consider a range of alternative sites for flood risk mitigation.</td>
</tr>
<tr>
<td>Land owners are unwilling to make land available for fluvial flood risk mitigation.</td>
<td>Assess whether modelling has been undertaken to assess impacts of climate change on surface water drainage.</td>
</tr>
<tr>
<td>Surface water drainage is adversely affected by climate change.</td>
<td>Ensure that preparation of detailed flood defence proposals take account of surface water drainage requirements.</td>
</tr>
</tbody>
</table>

### 12.21 Conclusions

12.21.1 There is a need to protect existing development within the study area from the risk of tidal flooding in particular. The existing tidal flood defences were not developed as formal defences, they are in multiple ownerships and there is no formal regime in place for their ongoing maintenance. Furthermore, the existing defences will provide a reduced level of protection over time as a result of climate change and increasing sea levels.

12.21.2 It is therefore important to improve the existing defences to protect existing development within the study area, and to formalise the responsibilities and maintenance regime for the defences. Indeed, the SFRA 2 Summary Report (http://www.bristol.gov.uk/sites/default/files/assets/documents/Avonmouth_SummaryReport_Phase 4_Final_v3b.pdf) states at paragraph 9.52:
Improvements to defences are considered essential for the Avonmouth/Severnside area to remain viable in the future given the scale of future flooding expected due to climate change.

12.21.3 Furthermore, the improvement of the existing flood defences is essential to achieving the area’s full economic development potential by enabling additional land for development to be brought forward. In the absence of any improvements to the area’s flood defences, it is unlikely to be acceptable to bring forward further green field land for economic development. Furthermore, it is unlikely to be acceptable to continue to bring forward previously developed land for economic development in the absence of a strategic solution because mitigation on a sit-by-site basis is likely to unacceptably increase the risk of flooding to others.

12.21.4 The SFRA 2 suggests a solution for improving the flood defences within the study area is to increase the height of the existing defences to 10.74m AOD at an estimated cost of £56.8m. This will not mitigate all risks of flooding and technical studies will be required to establish the residual risks. Site specific measures, including localised land raising, may be required to mitigate the residual risks.

12.21.5 More detailed technical studies are required to establish the feasibility of improving the coastal flood defences to the 10.74m AOD level. It will be necessary to model the impact of the flood defence options to properly assess their potential benefits. This work would need to be undertaken using the same modelling that has been used to inform the SFRA 2 to ensure consistency.

12.21.6 If additional green field development is to be accommodated within the central part of the study area, Core Strategy planning policies will need to be reviewed in the context of the recommendations of the SFRA 2 and will need to address the Sequential and Exception Tests.
13.0 District Heating

13.1.1 District heating is a system whereby heat is produced in a central location (for example “waste” heat from power stations or waste processing facilities) and is then transferred to buildings in the form of hot water. The heat transported in the water can be used to both heat and cool buildings.

13.1.2 A separate report about the study area’s potential for district heating is attached at Appendix 7. The Project Brief requires that we, in broad terms, establish if the development of a district heat or power distribution network is feasible and, if so, how this could/should be taken forward?

13.1.3 The development of district heating in this area needs to be seen in the context of the government’s aspiration for new non domestic buildings to reduce their energy requirements and be “zero carbon” by 2019. It also needs to be viewed in the context that new and existing development in the area principally comprises B1 (light industrial), B2 and B8 uses with some sui generis uses.

13.1.4 The development of district heating is likely to be most viable in new development where it will not need to compete with the low cost of existing heating networks that are already in the ground i.e. it is likely to be most viable in areas where new development is planned.

13.1.5 Both Councils have prepared separate studies about the opportunities for renewable energy generation within their areas to support their Core Strategies.

Potential for Renewable and Low Carbon Energy in South Gloucestershire


“greatest strategic opportunity for carbon reduction is the potential for a district heat network to supply heat from Severnside ERC and/or Rolls Royce to significant new development in the UWE / Harry Stoke and Cribbs/Patchway areas and potentially serving a wider catchment of existing buildings.”

However, a feasibility study about linking the Severnside area to strategic growth areas outside the study area is outside the scope of this study.

Bristol Citywide Sustainable Energy Strategy

13.1.7 Bristol City Council published a report in June 2009: Bristol Citywide Sustainable Energy Strategy (http://www.bristol.gov.uk/sites/default/files/documents/planning_and_building_regulations/planning_policy/local_development_framework/Bristol%20Sustainable%20Energy%20Study%20-%20Final%20Report%20%28rev1%20-%20CSE%2020090611.pdf). It analysed existing heat loads in Bristol alongside those expected from new development to identify Heat Priority Areas where conditions are likely to favour larger scale, economic and effective forms of sustainable energy generation such as district heating. The study area is not identified as a Heat Priority Area as the density of heat demand in the area is relatively low.

13.1.8 Bristol City Council’s report also notes that it is unlikely that a connection from Avonmouth to City Centre heat loads would be economic in the short term, although this could emerge in the longer term as a citywide heat network develops.
Buro Happold Study

13.1.9 The Buro Happold study at Appendix 7 notes that there are a number of generators of heat within the study area that provide an opportunity to develop a district heating system or series of systems in the study area.

13.1.10 The study is the subject of a number of important assumptions, including about the mix and density of development and presents a best case scenario for the feasibility of the district heating network.

13.1.11 In particular, the study assumes that all new development on green field land within the area will require space heating (in contrast to existing development in the area where only about 50% of buildings have such heating).

13.1.12 Furthermore, it is likely that much of the existing building stock within the study area is heated by radiant space heating that would need to be replaced by new heating systems that are capable of taking advantage of district heating systems. It is not known whether it would be viable to replace existing heating systems within the building stock to facilitate district heating. The costs in the study exclude the costs associated with upgrading heating systems within existing buildings to facilitate the use of district heating.

13.1.13 The study identifies that there is a significant number of generators of heat within the study area that could be used in a district heating system. Although there is the potential to generate electricity (via, for example, wind and solar technologies) to distribute beyond the study area, the study concludes that a local heat distribution network powered mostly with biomass and energy from waste Combined Heat and Power (CHP) plants offers the best renewable energy opportunity for the Avonmouth Severnside area because it will maximise the environmental benefits of the low carbon/renewable energy generated in the area.

13.1.14 Much of the existing development in the study area is focused in the south (Avonmouth), but substantial additional development is anticipated in the Severnside area in the north in the future under the terms of the 57/58 permissions.

13.1.15 The study concludes that the best opportunity for developing a district heating system is within the green field land covered by the 57/58 permissions where the density of development is unlikely to be constrained. On the additional green field land with economic development potential, we have assumed that the density of development will be lower and this adversely affects its viability for development with a district heating system.

13.1.16 The evidence identifies some potential anchor loads in the study area that could benefit from a district heating system and the study suggests that further investigations be undertaken to initiate the development of a district heating network in the southern part of the study area and that consideration be given to subsequently expanding this to the northern part of the study area.

13.1.17 The study concludes overall that, based on a number of assumptions about the mix of development, installing a district heating network to serve new developments in the area covered by the 57/58 planning permission in the north of the study area could be economically feasible and could assist the feasibility of installing a network supplying existing developments within the study area, which otherwise will be borderline.

13.1.18 The development of a district heating network is not essential for realising the area’s economic development opportunity, but could help to attract businesses with a high energy demand into the
area. In the longer term, if such a system were viable, there is potential to link it to Bristol’s Heat Priority Areas.

13.1.19 The study does however include a number of important assumptions that will require further testing and presents a “best case” scenario that will need to be refined and validated with additional information and sensitivity analyses. In the event that a detailed analysis shows that the development of a district heating system is viable, it is likely to require the establishment of an Energy Services Company to fund the development and management of the network.

13.1.20 The study includes a number of recommendations for taking forward further investigations about the potential to establish a district heating system in the area. In particular, it recommends that the installation of a district heating system would, if further detailed work supports its viability, need to be promoted by an Energy Services Company.
14.0 Development Potential

14.1 Land Use

14.1.1 Although the Councils’ vision seeks to encourage “green and environmental technologies” into the area, from a land use planning perspective, our study assumes that the area’s future development will comprise a mix of B1/B2 (industrial), B8 (storage and distribution) and sui generis land uses. We anticipate that “green and environmental technologies” will fall within the B1/B2 (industrial) use class or will comprise sui generis uses.

14.2 Mix of Uses

14.2.1 Development plan policies for the study area generally seek to restrict B1 office and residential uses because of the potential transport implications and compatibility of such uses with existing uses in the study area. Development plan policies generally only support B2, B8 and some sui generis uses (including, for example, waste processing) within the study area.

14.2.2 For the purposes of our study, we have assumed that development plan policies will continue to restrict B1 office and residential uses within the study area up to 2050 and that any new development will predominantly fall within the use classes B2 and B8, or that it will comprise sui generis uses. This is likely to be the case for the area covered by the extant 57/58 planning permissions.

14.2.3 However, we anticipate that there is likely to be some limited potential to develop ancillary facilities to serve the needs of employees within and visitors to the area, including convenience food sales, catering and hotel uses. Any such uses are however unlikely to make up a substantial or material proportion of the overall quantum of development in the area between now and 2050 and would need to address the sequential and exception tests in respect of flood risk.

14.3 Employment Density

B2 and B8 Uses

14.3.1 The project brief requires that we use English Partnerships employment density guidance. However, that guidance was superseded in January 2011 by the publication by the Homes and Communities Agency (HCA) of the Employment Densities Guide 2010 (2nd Edition):

http://www.homesandcommunities.co.uk/employment-densities-guide-2nd-ed

14.3.2 Our study uses the figures for the Table of Employment Densities in section 3 and has been prepared on the basis of 1 FTE per 36 square metres of Gross External Floor Area (GEA) for B2 and 1 FTE per 80 square metres of GEA for B8 (large scale and high bay) development.

14.3.3 However, the employment density figures must be treated with some caution and only used as a very broad guide because the Table notes that the range of employment density is between 1 FTE per 18 to 60 square metres of GEA for B2 uses and that "wide variations exist arising from scale and storage duration" for B8 uses.

14.3.4 The notes in section 4.0 of the Guidance highlight some of the factors that can lead to variation in the employment density, including that smaller buildings generally have higher employment densities than larger buildings. The Guidance therefore recommends sensitivity testing in respect of the employment densities.
Within the study area, it is also worth noting that there are substantial open storage areas (including for cars and other vehicles). The Guidance provides no indication of the employment potential of such open storage areas, but it is likely to be significantly lower than sites of a similar size that are occupied by buildings within B8 use. The future expansion of the Port may require that more land is made available for open storage purposes for containers or other products that are imported/exported via that facility.

**Sui Generis Uses**

The study area is also occupied by a number of sui generis uses that include, for example, waste processing and open storage uses. It is anticipated that further growth in sui generis uses will need to be accommodated within the study area. However, there is no guidance about the employment density of such development.

We have therefore examined the proposals for a sui generis development on land at Avonmouth that is to be developed by Viridor as a Resource Recovery Centre. This is a substantial facility on a 8.3ha site with buildings with a floor area of about 28,000 square metres, but it will incorporate substantial areas of waste processing and storage and will only provide 70 FTE jobs. The employment density of this sui generis development is therefore 1 job per 400 square metres.

Another sui generis use by SITA for an energy from waste plant of about 14,500 square metres on a 10.2ha site of south of Severnside Works on Severnside Road would employ about 46 people and would therefore have an employment density of 1 job per 315 square metres of floorspace.

There are a number of other comparable facilities that occupy substantial sites within the study area but that provide relatively low levels of employment, including other waste treatment facilities, a power station and LNG storage facility.

On the basis of the above analysis, we have assumed that sui generis uses will have an employment density of 1 FTE job per 250 square metres (although this is a higher density than in the specific examples above).

**Development Density**

We have made a number of assumptions in assessing the potential density of development on development sites in the study area. These are outlined in the following sections.

The density of development of different sites within the study area is used to inform our estimates of employment that might be generated from different uses and to therefore inform analysis of the area’s economic development potential.

**Central Park**

We have initially analysed the development of the Central Park proposals (see Appendix 17) within the area covered by the 57/58 permission and noted that the individual development plots occupy about 85% of the overall development site. About 15% of the overall site area is used to accommodate access roads, drainage channels etc. We have used the same figures in our analysis.

Within each plot, the density of development in the Central Park proposals is about 35%, although it is slightly higher on some other sites within the area covered by the 57/58 permission. We have therefore used this figure to calculate the density of development that might come forward on any additional green field land within the area covered by the 57/58 permissions.
14.4.5 We have calculated the density of development of sites within the study area as a measure of the footprint of a building in relation to the overall area of a site (including, for example, parking, access roads, landscaping and surface water measures). Density is then expressed as the percentage of the site covered by the footprint of buildings.

14.4.6 Our measure of the density of development assumes that buildings are single storey, broadly following the recent pattern of development in the area.

**Previously Developed Land**

14.4.7 We examined the density of development of a number of recent proposals for the redevelopment of previously developed land within the study area. The density of development of such sites is in the region of 37.5%. We have assumed that the redevelopment of other previously developed sites will be undertaken at a similar density.

**Green Field Land**

14.4.8 Our assumptions about the density of development vary between those green field sites within the area covered by the 57/58 permissions and those outside that area.

14.4.9 Within the area covered by the 57/58 permissions, development is proceeding in a manner that is not unduly constrained by the area’s ecology or risk of flooding. We have examined the density of recent development within that area, and also the planned density of development illustrated in the Central Park marketing brochure at Appendix 17.

14.4.10 Our analysis concludes that the area is being developed with large scale premises on large sites and that the density of development in the recently completed and planned Central Park developments is approximately 35%. We have assumed that development within the area covered by the 57/58 permissions will continue at a similar density.

14.4.11 On other areas of green field land we have assumed that development will be at a lower density than within the area covered by the 57/58 permissions to reflect the need to:

- retain important existing site features (including drainage channels, hedges);
- incorporate GI corridors;
- provide some on site ecological mitigation and flood risk mitigation measures; and
- Include some sui generis uses that are typically of a lower density than B2 and B8 uses.

14.4.12 We have assumed that a further 5% of each site will need to be set aside for such measures and that the overall site density will therefore be 30% on green field sites outside the area covered by the 57/58 permissions.

**14.5 Development Rate**

**Past Development Rate – 2000 to 2010**

14.5.1 The plan at Appendix 21 illustrates the extent of new development within the study area over the last 10 years. The plan differentiates between development that has taken place on previously developed land and that which has taken place on green field land. It has been prepared using a variety of evidence including the area’s planning history, aerial photographic images and site visits.
14.5.2 Whilst development rates are extremely variable over time and difficult to project, our analysis indicates that the extent of development (by overall site area) within the study area over the last 10 years has been in the region of 160ha. This equates to a development rate of about 16ha of land per annum.

<table>
<thead>
<tr>
<th>Development 2000 to 2010</th>
<th>Approximate Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green field land</td>
<td>120ha</td>
</tr>
<tr>
<td>Previously developed land</td>
<td>39.6ha</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>159.6ha</strong></td>
</tr>
</tbody>
</table>

14.5.3 Our analysis differs from that undertaken by the West of England Partnership (see report of 18th March 2010 to their Planning, Housing and Communities Board at: [http://www.bristol.gov.uk/sites/default/files/assets/documents/1690%20BPAA%20Issue%203%20appendix.pdf](http://www.bristol.gov.uk/sites/default/files/assets/documents/1690%20BPAA%20Issue%203%20appendix.pdf)) that examined the period 1989 to 2009 and concluded that:

Some 280ha of industrial development was undertaken between 1989 and 2009 at Avonmouth, Severnside and Royal Portbury. This represents about 60% of the total arising across the wider Bristol area over these years.

14.5.4 However, that analysis suggests a development rate of 18 ha per annum between 2001 and 2009, but it included land within the Royal Portbury area. The annual development rate in our study is therefore comparable to that in the West of England study.

14.5.5 South Gloucestershire Council’s Employment Land Survey of April 2011 ([http://www.southglos.gov.uk/NR/rdonlyres/251DEC40-CF74-4CCF-AB82-944E0E1BEFF9/0/PTE110214.pdf](http://www.southglos.gov.uk/NR/rdonlyres/251DEC40-CF74-4CCF-AB82-944E0E1BEFF9/0/PTE110214.pdf)) states that only 744 square metres of additional floor space was created in the Severnside area within South Gloucestershire between 2010 and 2011. However, in the 5 year period from 2006 to 2011, there was a net gain of 95,885 square metres of floor area in the area (equivalent to 19,177 square metres per annum). At a density of about 35%, this would equate to about 27.5ha (equivalent to 5.5ha per annum).

14.5.6 Bristol’s Business Development Survey Report ([http://www.bristol.gov.uk/sites/default/files/documents/council_and_democracy/statistics_and_census_information/Business%20Development%20Survey%202011_0.pdf](http://www.bristol.gov.uk/sites/default/files/documents/council_and_democracy/statistics_and_census_information/Business%20Development%20Survey%202011_0.pdf)) notes a net loss of industrial and warehousing floorspace between 2010 and 2011, but notes that there were extant planning permissions for more than 200,000 square metres of such development outstanding within the area and that since April 2006, there has been a net gain of almost 50 ha of industrial and warehousing land in Avonmouth.

14.5.7 The combined area of new industrial and warehousing development in Bristol and South Gloucestershire between 2006 and 2011 is therefore about 77.5ha. This broadly correlates with the 160ha identified in our analysis from 2000 to 2010.

14.5.8 The past rate of development over the last 10 years provides an indication of the rate of development that might be expected within the study area in the future. We have based our
assumptions about the future rate of development in the study area on this past rate of
development. Our assumptions about the future rate of development in the study area are set out in
the separate report: Avonmouth Severnside Outline Development Strategy.

14.6 Assumptions about Development of the 57/58 Permissions

14.6.1 The plan at Appendix 10 illustrates the the remaining green field areas covered by the 57/58
permissions. About 350 ha of green field land remains available for development under the 57/58
permissions.

14.6.2 We have used the density of the planed Central Park development (i.e. 35%) to inform an analysis
of the likely employment to be generated within the area covered by these permissions.

14.6.3 We have also cross referenced our analysis of the proposals for that area with the recent proposals
by Astra Zeneca to develop about 32ha of part green field and part previously developed land with
up to about 120,000 square metres of floor space (planning permission ref. PT10/02630/O) in area
on the plan at Appendix 10. The proposed density of development in that scheme is about 37.5%
which is slightly higher than the assumption that we have used because it includes some previously
developed land.

14.6.4 However, it should also be noted that some sites covered by the 57/58 permission have been
developed with B2 uses (including GKN and Warburtons). If further B2 uses come forward within the
area covered by the 57/58 permission, this would increase the employment density and potential of
the area.

14.7 Green Field Land Available for Development

14.7.1 Our analysis of the constraints within the study area identified a number of areas of green field land
outside the area covered by the 57/58 permissions that could potentially be brought forward for
development and these are shown on the plan at Appendix 10 and in the extract below:
Extract from Plan at Appendix 10 Showing Additional Green Field Land with Economic Development Potential

14.7.2 The areas of green field land are identified in five separate parcels: 1, 2, 3, and 4. These areas are in addition to the 57/58 permissions that includes about 350 ha of green field land.

14.7.3 We concluded that:
site 1 could provide about 3ha of green field development. It is to the north of an existing developed site that is allocated for residual waste treatment;

site 2 could provide about 46ha of green field development. It comprises a substantial part of an area known as Crooks Marsh Farm. The area is outside any COMAH Inner Consultation Zones, but its development will be constrained along its south west boundary with the adjacent railway line by the presence of underground pipes;

site 3 could provide about 7ha of green field development. It incorporates a pond that may be of ecological importance and that may need to be retained, but it is otherwise surrounded by development including the existing railway line and M49; and

site 4 could provide about 7ha of green field development. It is adjacent to a substantial spoil heap and may be contaminated. It has an existing road frontage from where access could be provided. The adjacent land to the north east is within the functional flood plain.

14.7.4 Other areas of green field land within the study area are the subject of constraints that limit their economic development potential. The constraints include the functional floodplain (Flood Zone 3b – see the plan at Appendix 18) and the COMAH Inner Consultation Zones (see the plans at Appendix 11).

14.7.5 On all of the additional green field sites with economic development potential, we have assumed a density of development of 30% to allow for on site ecological enhancements and surface water management and the retention of some existing landscape features. This is below the density of development of about 35% that is currently taking place within the area of the 57/58 permissions.

14.7.6 We have also assumed that the specific development mix within these sites could be dictated by planning policies (unlike the development of the land covered by the 57/58 permissions and the redevelopment of previously developed land over which there is little opportunity to control the precise mix of uses). We have assumed that the mix of development on these sites would be skewed towards a greater proportion of B2 than B8 uses to reflect the Vision for the area in the Project Brief.

14.7.7 In addition, site 4 is owned by Bristol City Council and we have therefore assumed that, as land owner, the Council will be able to dictate the mix of development on the site.

14.7.8 An analysis of the development potential of the green field land within the area covered by the 57/58 permission, the additional green field land identified in this study and previously developed land within the study area is set out in the separate report: Avonmouth/Severnside – Outline Development Strategy.

14.7.9 Our identification of the additional green field land with economic development potential assumes that each site would pass both the Sequential and Exception Tests in PPS25. In the event that proposals only passed the Sequential (and not the Exception) Test, the area of land that could be developed (and consequently the number of new jobs that could be accommodated) would be reduced.

14.7.10 In particular, if the area of site 2 within the breach hazard bandwidth could not be developed, it would reduce the extent of that site by about two thirds and would make the remaining land difficult and/or more expensive to access. It would also eliminate the possibility of development on site 1.
14.7.11 If development of the additional green field sites was not taken forward within the breach hazard bandwidth it would decrease the potential new jobs that could be accommodated within the additional green field land that we have identified by more than 50%.

14.7.12 If additional green field land is brought forward for economic development, a similar area of land will be required to provide ecological mitigation. The land for ecological mitigation identified in the Cresswell study would however be sufficient to compensate for the development of the additional green field land identified for economic development in this study. About 60 ha of additional land would be required for ecological mitigation at an estimated cost of:

<table>
<thead>
<tr>
<th>Item</th>
<th>Calculation</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Acquisition/Agreement Cost</td>
<td>60 x £12.5k</td>
<td>£0.75 million</td>
</tr>
<tr>
<td>Works Cost</td>
<td>60 x £20k</td>
<td>£1.20 million</td>
</tr>
<tr>
<td>Total Cost</td>
<td></td>
<td>£1.95 million</td>
</tr>
</tbody>
</table>

14.7.13 In the context of the limited amount of additional green field land available for development beyond that identified in the 57/58 permission, we have identified this as the “optimum” option for realising the area’s full potential for economic development.

14.8 Conclusions

14.8.1 The evidence about past development rates and the density and mix of economic development in the study area will be used to inform an analysis of the economic development potential of additional green field and previously developed land within the study area.

14.8.2 The development of the remaining green field land covered by the 57/58 permissions and the development of the additional green field land identified within this study area could provide about 412ha of economic development. The extent of this land is shown on the plan at Appendix 10 that also highlights the potential ecological mitigation areas identified in the separate study by Cresswell.

14.8.3 The separate Avonmouth Severnside Outline Development Strategy examines the potential for this green field land and previously developed land to provide sites for additional employment within the study area to help the Councils realise their vision for the area. It uses the evidence from this report to inform its conclusions.
15.0 Funding

15.1.1 Options for funding the infrastructure and mitigation identified in this report are dealt with in the separate report: Avonmouth Severnside Outline Development Strategy. The Project Brief specifically requires that we examine the extent to which infrastructure that might be required in the area could be funded via:

- s106 obligations;
- Community Infrastructure Levy (CIL);
- Accelerated Development Zone and Tax Increment Funding (TIF); or
- “other tariff mechanisms”.

15.1.2 These matters are dealt with in more detail in the separate report, but it is appropriate that the potential for funding via s106 obligations and CIL are included in this report because they are closely related to planning policy matters.

15.2 S106 Obligations

15.2.1 In considering development proposals within the study area, the Councils are currently able to seek s106 obligations to mitigate the impacts of development. However, any such contributions can only be used to mitigate the impacts of the new development being proposed, rather than address existing problems.

15.2.2 S106 contributions can no longer be pooled across the study area to fund infrastructure. The focus of such obligations should now be on mitigating the site specific impacts of development proposed. Where funding needs to be pooled from development across the study area, the Councils will now need to consider the use of CIL, rather than s106 obligations.

15.2.3 S106 obligations will however continue to be suitable for seeking to mitigate the site specific impacts of development, such as site specific transport improvements.

15.3 Community Infrastructure Levy (CIL)

15.3.1 It is anticipated that CIL will be used to provide the infrastructure required to support the development of an area. This mechanism could therefore be used to raise funds to develop infrastructure within the study area. However, Bristol's current consultation about its draft CIL charging schedule suggests that economic development within the study area will not be liable for CIL.

15.3.2 Furthermore, CIL will not in any event apply to extant planning permissions and could not therefore be raised from the development of the land within the area covered by the 57/58 permissions.

15.3.3 It is however possible for the Councils to consider the priority for the spending of CIL generated elsewhere within their areas on infrastructure within the study area. CIL funding generated outside the study area could be pooled and used to fund infrastructure within the study area.

15.3.4 Therefore, although there is unlikely to be potential to generate CIL from economic development within the study area, there is potential for the Councils to allocate CIL collected elsewhere to fund infrastructure within the study area (Bristol's current consultation suggests that it anticipates that development in the Council's area will generate about £4 million per annum from year 4 onwards).
15.4 Conclusions

15.4.1 There will only be limited opportunities to secure funding for infrastructure in the area via s106 obligations and there will be little opportunity to generate CIL from development within the study area. The Councils will need to consider whether to allocate CIL collected elsewhere within their areas towards infrastructure within the study area.
16.0 Conclusions

16.1.1 This study has identified that the study area has significant economic development potential. However, that potential is unlikely to be realised in a sustainable manner unless the supporting infrastructure is brought forward together with the mitigation that is required to address the impacts of that development.

16.1.2 The study identifies the potential scale of development that is feasible with current and future constraints. The potential includes the economic development of previously developed land, about 350ha of green field land that has yet to be developed under the 57/58 permissions and an additional area of about 60 ha of greenfield land elsewhere within the study area.

16.1.3 The infrastructure that is required to protect existing development and infrastructure in the area and to facilitate further economic development and infrastructure includes a strategic flood defence, transport infrastructure (principally a new M49 junction) and ecological mitigation measures. The study estimates that the cost of this infrastructure is likely to be in the region of £110m.

16.1.4 The plan at Appendix 10 illustrates the areas where infrastructure and mitigation will be required to facilitate the area’s economic development to help realise the Councils’ vision. The plan does not include proposals for the location of a strategic flood defence, but the SFRA 2 suggests and the Environment Agency supports proposals for the improvement of the existing defences, with the development of some additional defences in the event that it is not possible to improve the existing defences.

16.1.5 The study indicates that if the funding is available to provide the infrastructure and mitigation that is required to facilitate the area’s economic development, the Councils’ shared Vision for the area is capable of being realised.

16.1.6 The separate report Avonmouth/Severnside Outline Development Strategy considers the options for realising the opportunity for the area’s economic development and proposes an Outline Development Strategy. It assesses the costs, benefits and value for money of the proposed Outline Development Strategy and identifies one way in which it could be implemented.

16.1.7 Further detailed work will be required to explore the infrastructure and mitigation options available to bring forward the area’s economic development to realise the Councils’ shared Vision in a sustainable manner.

16.1.8 Finally, there is an opportunity to realise a district heating system within the study area, but this is only likely to be feasible in the event that there is demand for heat within the study area from both new and existing development.
Appendices
Dear Mr Strange

DEVELOPMENT OPTIONS FOR AVONMOUTH/SEVERNSIDE

I refer to your consultations regarding the above.

In response the Environment Agency would make the following comments in respect of its position in the general context of the Avonmouth and Severnside area, in addition to addressing the specific issues detailed in your emails dated 21 February and 4 March 2011:

Context

1) Avonmouth / Severnside is a low lying area adjacent to the Severn Estuary with the mouth of the River Avon to the south west. The area is drained by a large network of artificial rhynes and control structures. The Agency’s current flood mapping of the Avonmouth/Severnside area shows it lying wholly within Flood Zone 3, i.e. the 1 in 200 year tidal floodplain of the Severn Estuary.

2) The tidal defences along Avonmouth/Severnside are sub-standard. Current defences along the estuary provide a variety of standards of protection ranging between 1in10 (Port Lock Gates) to a 1in 200. Even though the area is protected by a combination of EA and privately maintained defences (e.g. Bristol Port) these vary in terms of design and materials. The defences do not therefore, provide protection to the required standard, as detailed in PPS25, either now or to accommodate the effects of climate change over the lifetime of the development.

3) The recommended standard of protection for new development to be safe from tidal flooding is identified as 1in 200 years plus an allowance for climate change. As already mentioned, the current defences along the sea frontage do not provide this level of protection.

4) This risk is reiterated by Bristol City Council’s Level 2 SFRA, which duplicates the Capita Symonds Avonmouth/Severnside assessment dated 2007. Figure 7.2 and 7.3 in the Avonmouth/Severnside study shows the actual flood risks to the area. Current climate change predictions indicate a sea level rise of approximately 1m by 2105 resulting in significant overtopping. This equates to depths of flood water in the region of 0.5m to 2m across the Avonmouth/Severnside area. When the depths and velocities are translated to Defra’s “Flood Risks to People” flood hazard category system this displays a very dangerous risk. There is a combination of “danger for most” and “danger for all” across the whole site.
5) As the RDA are aware Phase 4 of the Avonmouth/Severnside study, has been updated to take into account PPS25 climate change figures. The study provides more mapping on today’s and future flood risks, which again shows this area is significantly at risk of flooding. As a result of climate change the depths have increased over the study area with their associated DEFRA hazard rating.

6) The Phase 3 study estimated that it would cost in the region of £16 to £280 million to upgrade the defences. Flood protection would need to be provided for the whole tidal cell rather than just partial improvements. Phase 4 clearly puts forward a strong message that a strategic flood risk management approach is required to enable new development. The preferred approach is to improve the tidal defences.

With regard to the specific questions raised in your email dated 4 March 2011, the Agency would comments as follows:

As Phase 3 has never been fully adopted or made available in the public domain, it has been very difficult for the both LPA’s and the Agency to use the outputs to inform LDF policies and take the strategic mitigation measures forward.

Over recent months we have seen a number of enquiries/applications for energy/waste industry developments. The only evidence available to inform site specific FRA’s has been the Phase 3 executive summary, which does not provide sufficient detail regarding the strategic mitigation measures required. As a result, to make development safe from a flood risk perspective, the Agency has responded to these applications on a site by site basis (land raising and the provision of an emergency plan) to enable respective development proposals to pass the Exception Test, as detailed in PPS25.

Once Phase 4 is completed and adopted by both councils, this will need to be used to inform LDF policies for the area and to establish how flood risk management will be taken forward to facilitate development. A more “strategic approach” to Avonmouth /Severnside, when considering flood risk, will need to be taken forward in agreement with all statutory parties.

The principle matter of whether the site is green or a recycled brown site makes no difference to our approach in respect of development in Avonmouth/Severnside, due to the requirement to demonstrate that the development will be safe for its lifetime, in accordance with PPS25. It must be noted that transforming more green land to hardstanding will result in additional surface water volumes being discharged into the rhyne system. If not mitigated, this could increase flood risk locally, due to the time it takes for the area to drain due to the tide and ground conditions.

As the Agency is the Councils’ flood risk advisor, it will need to make a clear representation to both LPA’s about the risks and implications of continuing a site specific approach. It must be understood that it is not a sustainable approach as the cumulative impact of land raising, as explained in the Phase 4 SFRA, has a detrimental impact due to a loss in overtopping storage volume, creating an increased risk in flooding to third parties. The risk of breach would also still be present. To summarise, this approach is unacceptable and contrary to government policy, as detailed in PPS25.
It is doubtful whether the length of defence could be delivered in a phased manner, on the grounds that it would still get flanked from low spots. However, it may be possible to provide the final design height in a phased approach, thereby ensuring the provision of an appropriate defence when it is actually needed. Detailed design would need to investigate the phased approach, particularly in respect of the inherent costing implications.

On site mitigation would still be required as a factor of safety, in case of residual flooding from overtopping events.

**Q) Would we allow development without a strategic solution so that money can be collected.**

It's very unlikely that there is sufficient development to fund a scheme via a S106 agreement however, it is assumed that alternative funding mechanisms are being investigated. As this is critical infrastructure for new and existing development, the preferred option is to ensure delivery at the earliest opportunity, to prevent piecemeal development taking place in a high flood risk area.

There needs to be an agreed strategy informed by the SFRA conceptual outputs and this economic study, to inform planning policies and guide the determination of planning applications. There would appear to be no reason why a detailed design study should not be progressed to address outstanding issues. This could potentially include: joint wave/tide assessment, ground conditions assessment, land ownership and defence crest height requirements. This would better inform the formulation of a developer contribution policy.

**Q. EA/DEFRA funding status**

As we need to prioritise our capital schemes at a national level, it is unlikely that funding would be secured due to the low residential nature of the area.

**Q. Would the EA take the lead on developing a strategic solution if other funding becomes available?**

At this stage it is difficult for the Agency to provide a definitive response to this question, on the grounds that there is no agreed strategy. The Agency has previously provided the lead on technical aspects of detailed design studies, in respect of similar projects. This has been subject to an approved/agreed strategy, which has the funding already collected, or as a minimum, has appropriate mechanisms to secure funding in place.

Should you wish to discuss these issues further, please contact Nigel Smith at this office (tel: 01278 484807).

Yours sincerely

**DAVE PRING**
Planning Liaison Technical Specialist

Direct dial 01278 484627
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author
Andrew Dannatt

signature

date 02 September 2011

approved
Tim Denton

signature

date 02 September 2011
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With regard to the 57/58 consented land parcel it is inevitable that further land raising in this area is likely and that it needs to be integrated and “planned” into any future development scenarios and flood risk mitigation strategies.

8.6 Recommended Further Study

9 References

Appendix A – Existing Site Plan
Appendix B – 1 in 200 year Existing Flood Extent
Appendix C – 1 in 200 year Climate Change 2105 Flood Extent
Appendix D – Developable Land showing Breach Hazard
Appendix E – Key Correspondence
1 Executive Summary

This flood risk strategy has been prepared by Buro Happold Ltd on behalf of SWRDA and the Councils of Bristol City and South Gloucestershire for the proposed development of the Avonmouth/Severnside area, Bristol, Avon. The strategy has been developed in accordance with the guidelines set out in Planning Policy Statement 25 Development and Flood Risk (PPS25), as well as other guidelines and procedures.

The principal flood risk to the site is the Severn Estuary, which is tidally influenced at the Avonmouth/Severnside frontage. Climate change impacts are predicted to generate a gradual long term increase in the average sea levels in the adjacent estuary in years to come. There is also a fluvial risk of flooding within the site.

The site is currently defended, or protected, against flooding from extreme tidal events. However, and importantly, the Environment Agency classifies areas into one of three Flood Zones based on risk of flooding from the river or sea, not taking into account any flood defences; the Avonmouth/Severnside study area is therefore identified to be almost entirely within Flood Zone 3a.

The following principal sources of data and Information have been used in the preparation of this strategy:

- Strategic Flood Risk Assessment - Level 2 report (SFRA)
- Severn Estuary Shoreline Management Plan
- Severn Estuary Strategy – Consultation January 2011

The SFRA identifies the 10.74m AOD defence as a potential solution to mitigate tidal flood risk in the area. Providing a higher defence level gives added protection against overtopping and reduces the likelihood of breach, but it comes at a high cost (economic and environmental). The Port, within the Deep Sea Container Terminal development within the south west of the study area, is intending to implement proposals to provide a 10.67m AOD defence along part of the estuary frontage and this is scheduled for construction in 2015. In addition to these works, further mitigation measures (e.g. raising land levels for buildings) should be brought forward within the study area to deal with risks from wave overtopping, breach and fluvial flood risk that would not be addressed by the above measures. Implementation of these mitigation measures may require the Environment Agency’s Compulsory Purchase Order powers.

The EA consultation on the Severn Estuary Strategy suggests that a strategic solution be developed in stages, either behind the existing railway line or by raising the railway line and converting the existing embankment into a formal flood defence. From an engineering, environmental and economic perspective the repair/improve alternative would be more preferable, although Network Rail may not readily approve such a formal use of their railway embankment. A phased strategic solution behind the existing defence would provide flexibility in the funding stream and would allow some redevelopment of previously developed land within the study area.
Some land raising (that will occur anyway as a result of the 57/58 consent) will be required as the introduction of highways, infrastructure and safe access routes are implemented to better serve the community and the wider area. This work could proceed in advance of a strategic solution coming forward provided it fitted within the strategic framework.
**Glossary**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tr>
<td>Actual Risk</td>
<td>The risk that has been estimated based on qualitative assessment of the performance capability of the existing flood defences</td>
</tr>
<tr>
<td>Attenuation</td>
<td>A method to reduce a flood peak to prevent flooding, increasing the duration of the flow</td>
</tr>
<tr>
<td>Breach</td>
<td>Failure of flood defences or other infrastructure acting as a flood defence, potentially causing flood related hazards</td>
</tr>
<tr>
<td>Brownfield</td>
<td>Land previously developed that has potential to be regenerated</td>
</tr>
<tr>
<td>Catchment Flood Management Plan (CFMP)</td>
<td>A CFMP is a large scale strategic planning framework for the integrated management of flood risks to people, natural and developed environment in a sustainable manner</td>
</tr>
<tr>
<td>Catchment</td>
<td>A river catchment is the area which the river drains either naturally or with artificial engineering. A surface water catchment is the area which water drains into a river. A groundwater catchment is the area that consists of the groundwater river flow.</td>
</tr>
<tr>
<td>Coastal Defence</td>
<td>To provide protection from coastal erosion and/or tidal flooding</td>
</tr>
<tr>
<td>Design Flood Level</td>
<td>This is the level of flooding that flood defences or mitigation measures are designed against. This is typically the 1% (1 in 100) flood level.</td>
</tr>
<tr>
<td>Discharge</td>
<td>The rate of flow of water measured in terms of volume per unit time</td>
</tr>
<tr>
<td>Flood Defence</td>
<td>A natural or man-made infrastructure used to prevent certain areas from inundation from flooding, and/or the provision of flood warning systems</td>
</tr>
<tr>
<td>Floodplain</td>
<td>Area of land adjacent to a water course on which water flows or is stored during a flood event, or would otherwise be flooded in the absence of flood defences</td>
</tr>
<tr>
<td>Flood Resilience</td>
<td>Improving flood resistance, e.g. reducing the risk of properties against...</td>
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</table>
flooding events

**Flood Risk**

The level of risk to personal safety and damage to property resulting from flooding due to the frequency or likelihood of flood events

**Flood Risk Assessment (FRA)**

An assessment of the flood risks to the proposed development over its expected lifetime and the possible flood risks to the surrounding areas, assessing flood flows, flood storage capacity and runoff

**Flood Risk Management (FRM)**

Managing/reducing flood risk to people, property and the environment

**Flood Warning Systems (FWS)**

A system by which to warn the public of the potential of imminent flooding. This is typically linked to a flood forecasting system

**Flood Zones**

An area susceptible to flooding with a level of risk defined by the Environment Agency according to PPS25 Table D.1:-

- **Zone 1 Low Probability**
  
  Land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).

- **Zone 2 Medium Probability**
  
  Land assessed as having between 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any year.

- **Zone 3a High Probability**
  
  Land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

- **Zone 3b Functional Floodplain**
  
  Land where water has to flow or be stored in times of flood – usually defined as the in 20 floodplain.

**Fluvial Flooding**

Related or connected to a watercourse (river or stream)

**Freeboard**

An allowance for uncertainty and/or imprecise engineering allowances
<table>
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<tr>
<td>Greenfield</td>
<td>Land which has not been previously developed such as settlement.</td>
</tr>
<tr>
<td>Groundwater</td>
<td>Water present within underground strata known as aquifers</td>
</tr>
<tr>
<td>Groundwater Flooding</td>
<td>Surface flooding resulting from high ground water levels.</td>
</tr>
<tr>
<td>Inundation</td>
<td>Flooding of land with water</td>
</tr>
<tr>
<td>L1 SFRA</td>
<td>Level 1 Strategic Flood Risk Assessment – assessment carried out on an administrative area</td>
</tr>
<tr>
<td>L2 SFRA</td>
<td>Level 2 Strategic Flood Risk Assessment – more detailed assessment on specific area that requires more detailed investigation</td>
</tr>
<tr>
<td>LIDAR</td>
<td>Airborne laser scanning of topography</td>
</tr>
<tr>
<td>Mitigation</td>
<td>Actions taken to reduce either the probability of flooding or the consequences of flooding or a combination of the two</td>
</tr>
<tr>
<td>Previously Developed Land (PDL)</td>
<td>Land which is or was occupied by a permanent structure (excluding agricultural or forestry buildings) and fixed surface infrastructure</td>
</tr>
<tr>
<td>Refuge</td>
<td>Area for shelter / protection during flood events</td>
</tr>
<tr>
<td>Residual Risk</td>
<td>The risk that remains after risk management and mitigation measures have been implemented</td>
</tr>
<tr>
<td>Resilience</td>
<td>Improving the flood resistance, e.g. Buildings</td>
</tr>
<tr>
<td>Rhine or rhyne</td>
<td>Network of flat ditches to convey irrigation/surface water – pronounced “reen”</td>
</tr>
<tr>
<td>Risk</td>
<td>Risk is the probability that an event will occur and the impact (or consequences) associated with that event</td>
</tr>
<tr>
<td>Runoff</td>
<td>Water flow over surfaces to the drainage system. Runoff occurs if the ground is impermeable or if permeable ground is saturated.</td>
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<tr>
<td>Term</td>
<td>Definition</td>
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<tr>
<td>Shoreline Management Plan</td>
<td>A large-scale assessment of the risks associated with coastal process</td>
</tr>
<tr>
<td>Strategic Flood Risk Assessment (SFRA)</td>
<td>An SFRA is the assessment and ‘categorisation’ of flood risk on an area-wide basis in accordance with PPS25</td>
</tr>
<tr>
<td>Surface Water Flooding</td>
<td>Surface water flooding occurs when the volume of water is unable to filtrate through the ground to enter drainage systems, and therefore runs quickly off land and results in localised flooding. This type of flooding is usually associated with intense rainfall.</td>
</tr>
<tr>
<td>Sustainable Drainage Systems (SuDS)</td>
<td>SuDS are used as a strategy to manage surface water in a sustainable manner or least damaging solution through management practices and physical structures.</td>
</tr>
<tr>
<td>Sustainable Development</td>
<td>Development which meets the needs of the present without compromising the ability of future generations to meet their own needs</td>
</tr>
<tr>
<td>Tidal Flooding</td>
<td>Related or connected to the sea or estuary</td>
</tr>
<tr>
<td>Water Table</td>
<td>The top surface of the saturated zone within the aquifer</td>
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### Abbreviations

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<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>AEP</td>
<td>Annual Probability of Exceedance</td>
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<td>CFMP</td>
<td>Catchment Flood Management Plan</td>
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<tr>
<td>Defra</td>
<td>Department of Food and Rural Affairs</td>
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<tr>
<td>EA</td>
<td>Environment Agency</td>
</tr>
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<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>FRA</td>
<td>Flood Risk Assessment</td>
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<tr>
<td>LDF</td>
<td>Local Development Framework</td>
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<td>LPA</td>
<td>Local Planning Authority</td>
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<td>PDL</td>
<td>Previously Developed Land</td>
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<td>Regional Flood Risk Assessment</td>
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<td>Strategic Flood Risk Assessment</td>
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<td>SMP</td>
<td>Shoreline Management Plan</td>
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<tr>
<td>SoP</td>
<td>Standard of Protection</td>
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<tr>
<td>SuDS</td>
<td>Sustainable Drainage System</td>
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2 Introduction

An overview of the wider project is provided in a separate report by WYG, the Lead Consultant for this commission.

This report provides the advice and information about flood risk within the study area and the options for mitigating that risk. It seeks to identify the potential costs (based on evaluation by others) and risks of those options.

The information from this report is intended to feed into a “green book appraisal”, although it is likely that further detailed investigations will be required before it is possible to complete such an appraisal. This report identifies some of the additional work that will be required to inform a robust appraisal.
3 Project Description

3.1 Site Location

The study area is to the north east of Bristol. It occupies an area of approximately 1600Ha and is bounded to the west by the Severn Estuary and, generally, by the M49 to the east. The area is a mix of industrial, storage and distribution and infrastructure developments with agricultural and other undeveloped land.

The study area is generally flat and low-lying with a slight slope rising gently eastwards from the coast. Ground levels are predominantly low at the north-eastern boundary with an elevation of approximately 4mOD where fluvial watercourses exist, rising to 7m OD to the south-west, where the railway embankment creates an upstanding linear feature. An existing site plan is shown in Figure 3-1 and in Appendix A.
3.2 Site Description

The site is adjacent to the Severn Estuary and is protected from flooding from the tidal river by existing flood defence walls.

One of the principal landholdings in the study area is that of Astra Zenica (formerly ICI) which historically included a sizeable chemical works. Whilst the built form of these works has generally decreased in overall size with time, their original landholding benefits from 1957/58 planning consents designed, at the time, to allow ICI to expand their business with relevant works-related development on their site. These planning permissions have subsequently allowed the site to be developed without incurring obligations to provide supporting infrastructure, or deal with flood risk through the normal planning processes.

Bristol Port in the south of the site has diversified during the twentieth century and, alongside conventional cargo handling, now houses logistics and warehousing businesses together with fuel supplies and car importation/preparation facilities.

3.3 Site Observation

A site visit was carried out on 7th October 2010 to familiarise the study team with the Avonmouth/Severnside study area. The high degree of heavy industrial development, the low lying topography and the close proximity of the site to the Severn Estuary was particularly noted. Travelling from the south by Bristol Docks, it was evident, and as expected, that dockside operations and port related industry remains in close proximity to the port itself. At the northern end of the site, remote from the port, warehouses and logistics centres prevail with the chemical works site.

It was clear that most of the newer developments had floor levels that had been raised above an anticipated flood level, considerably higher than the existing ground level; refer to Figure 3-1 below. There was evidence of sustainable drainage systems in operation.

![Figure 3-2 Typical views of Avonmouth/Severnside](image-url)

The railway from Avonmouth to Severnside performs as an informal flood defence.
It was considered that the conclusion from the L2 SFRA is valid, namely that the primary flood risk to the site, both now and increasingly in the future, is likely to occur due to a breach in the flood defence wall on the estuary, allowing tidal water flows to pass generally over and throughout the Avonmouth and Severnside area. However, we comment later in this report about the risks to the area from fluvial flooding and the additional work that will be required to investigate this matter if additional land is to be brought forward for development within the study area.

3.4 Available Information
The information reviewed and utilised within this assessment included the following principal documents:

- Shoreline Management Plan (Environment Agency)
- Bristol Avon Catchment Flood Management Plan (Environment Agency)
- Avonmouth/Severnside Level 2 Strategic Flood Risk Assessment (Capita)
- Severn Estuary Strategy - Managing flood risk on the Severn Estuary - South Gloucester to Hinkley Point, Somerset (Environment Agency)

A detailed schedule of references is contained in Section 10.

3.5 Flooding History
The documents reviewed do not indicate that Avonmouth/Severnside has been recently inundated from tidal or fluvial flooding. However, many instances of flooding are recorded in the surrounding Avon and Severn Tributaries’ catchments.

3.6 Consultations
3.6.1.1 Environment Agency
Consultation has been undertaken with the Environment Agency throughout the development of this report through the Wessex Area Development Control team, Dave Crowson and Nigel Smith.

Key correspondence is in Appendix D of this report.

3.6.1.2 Bristol City and South Gloucestershire Councils
The Councils have been engaged throughout the preparation of this report and representatives attended the site reconnaissance visit and later workshop held on 18th January 2011.
4 Policy Context

4.1 International Context

4.1.1 European Commission Flood Directive (2007/60/EC)
This directive requires all member states to assess whether water courses, including the coast are at risk from flooding. This includes the mapping of flood extents, the risks to humans and assets in these areas, whilst taking adequate and coordinated measures to reduce the flood risk. The directive enforces the right of the public to gain access to above information and to be involved in the planning process.

4.2 European Context

4.2.1 Water Framework Directive
The European Water Framework Directive came into force in December 2000 and became part of UK law in December 2003. It gives the Environment Agency an opportunity to plan and deliver a better water environment, focussing on ecology. The Directive helps to protect and enhance the quality of:

- surface freshwater (including lakes, streams and rivers)
- groundwater
- groundwater dependant ecosystems
- estuaries
- coastal waters out to one mile from low-water.

Previously, a range of inconsistent European legislation covered different aspects of water management. The Directive aims to introduce a simpler approach which will result in greater protection for a vital part of our environment. The Environment Agency is the 'competent authority' for carrying out the Directive.

4.3 National Context

4.3.1 Planning Policy Statement 25
This flood risk assessment (FRA) has been undertaken in accordance with Planning Policy Statement 25 (PPS25) March 2010. This document provides the latest guidance on considering flood risk for new development. The aims of this policy are:

“to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk”

PPS25 also requires due consideration of climate change and potential impacts of development in the future.
Sequential Test

Under the guidance in PPS25, a sequential risk-based approach is required to ensure that new development is appropriate taking into account the relative Flood Zones (1, 2 and 3) and the Vulnerability Classifications given in Annex D2 of PPS25 summarised below:

PPS25 states:

“Local Planning Authorities allocating land in Local Development Documents (LDD) for development should apply the Sequential Test to demonstrate that there are no reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed.”

“The overall aim of decision-makers should be to steer new development to Flood Zone 1. Where there are no reasonably available sites in Flood Zone 1, decision-makers identifying broad locations for development and infrastructure, allocating land in spatial plans or determining applications for development at any particular location should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2, applying the Exception Test if required. Only where there are no reasonably available sites in Flood Zones 1 or 2 should decision-makers consider the suitability of sites in Flood Zone 3, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required.”

“In areas at risk of river or sea flooding, preference should be given to locating new development in Flood Zone 1. If there is no reasonably available site in Flood Zone 1, the flood vulnerability of the proposed development can be taken into account in locating development in Flood Zone 2 and then Flood Zone 3. Within each Flood Zone new development should be directed to sites at the lowest probability of flooding from all sources as indicated by the SFRA.”

“The preparation and review of Regional Spatial Strategies (RSSs) and Local Development Documents (LDDs) should be used to review existing and proposed development in order to allocate land in lower flood risk zones.
suitable for existing vulnerable uses already in medium and high flood zones, and in doing so, to realise opportunities arising through redevelopment to improve the sustainability of communities.”

The majority of the study area is within an area classified by the EA as flood zone 3a (see Figure 4-1).

**Figure 4-1 Flood Zones (Reproduced from the SFRA Figure 7.1)**

The implication of the advice in PPS25 is that proposals for new industrial and warehousing development within the study area should address the “sequential test” i.e. demonstrate that there are no other “reasonably available” sites for the development.

Industrial and warehousing development within the study area would be classed as “Less Vulnerable” and would not, if the “sequential test” were satisfied, normally need to address the “exception test”. Refer to the Developer Checklist in Appendix E for further summary of PPS25.

The EA’s standing advice suggests that a sequential test may not be required where windfall sites have been designated, or where land allocations have been made by Local Authorities where the sequential approach has
already been demonstrated. Depending on the type of development proposed, sites that have been allocated may still have to satisfy the Exception Test (see below).

Exception Test

The study area lies principally within Flood Zone 3a (high probability) and therefore the Exception Test as defined in Section D9 of PPS25 is required to be satisfied in certain circumstances. PPS25 indicates that “the more vulnerable, highly vulnerable and essential infrastructure uses in Table D.2 should only be permitted in this zone if the Exception Test is passed”. The document states that for the exception test to be passed:

a. “it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by an SFRA where one has been prepared”;

b. “the development should be on … developable previously-developed land”; and

c. “a FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere”.

For the Exception Test to be passed all three parts would have to be satisfied.

Part a) would include, for example, securing local economic development opportunities, improvements to community facilities, improvements to the public realm and services that the proposed development would provide. Part b) indicates that development should only take place on “brownfield” land. In order to pass part c), development within the study area would have to demonstrate that if safe access and egress could not be achieved, then a strategic flood warning and evacuation plan would have to be implemented as recommended in the SFRA. It would also need to demonstrate that flood risk would not be increased elsewhere.

As part of the SFRA work on the Breach Hazard Bandwidth, an extended Flood Zone 3a policy was recommended. In addition to the requirements for development in Flood Zone 3a that are set out in PPS25, the extended policy recommended that the Exception Test should be passed for all types of development within the designated Breach Hazard Bandwidth zone (see plan at Error! Reference source not found.) and that development within that area should be limited to the “water compatible” and “less vulnerable” categories only. At all locations at risk of flooding from a breach in the flood defences (including those outside the defined Breach Hazard Bandwidth), FRA for individual developments will need to assess the risk of breach in more detail and also consider mitigation within the design of the building and layout and drainage of the site. The implication of this recommendation in the SFRA is that proposals for the development of unallocated greenfield land within flood zone 3a within the study area will need to satisfy both the sequential and exception tests.

For general industrial and warehousing development (B2/B8), developers (or the local planning authorities in considering the allocation of additional land for development) would need to first address the “sequential test” by demonstrating that there are no other suitable sites available within flood zones 1 and 2, and would then need to pass the “exception test” by demonstrating, inter alia, that there were no suitable brown field sites available. All
other suitable brownfield sites within the area of search in flood zones 1 and 2 would have to be considered and if none were suitable then greenfield sites in flood zones 1 and 2 would be considered. Only if none of those sites were suitable would it be appropriate to consider bringing forward greenfield sites for development within the study area.

There may be specific development proposals (for example those requiring proximity to the port or motorway network) where the area of search for suitable sites needs to be restricted to the study area itself to address the sequential test. However, in considering the allocation of additional “green field” sites within the study area for general industrial and warehousing development with less specific location needs, it is likely that the search area will need to cover land beyond the study area. It may be challenging to justify the allocation of such additional land where other suitable sites for such development exist within the Bristol and South Gloucestershire areas that are in flood zones 1 or 2. The allocation of such additional green field sites for general industrial and warehousing development will need to address the sequential test, and in the context of the potential availability of other suitable sites in flood zones 1 and 2 in the area, it may be difficult to pass this test.

If it is possible to demonstrate that there are no other suitable sites for general industrial and warehouse development, if the SFRA recommendations are followed, individual development proposals will then need to address the “exceptions test”. However, the development of further “green field” land within the study area would not pass this test and would therefore be considered unacceptable.

A key area of further study in considering the allocation of additional land for development within the study area will therefore be an analysis of other available sites for such development.

4.3.2 Making Space for Water

This relates the Flood and Coastal Erosion Risk Management Strategy in England (Defra 2004) and the Government’s responses to the consultation exercise (Defra 2005). Over the 20 year life time of the strategy, the Government is implementing a more holistic approach to managing flood and coastal erosion risk in England. The main aims of the strategy are to reduce the threat to people and their property, and to deliver the greatest environmental, social and economic benefit consistent with the Government’s sustainable development principles.

4.4 Regional Context

Regional planning policies in relation to flood risk are covered in detail in the separate planning policy report. The key regional policies that affect the study area principally concern the management of Severn Estuary. In this regard the EA have recently completed a consultation on the Severn Estuary Strategy (see references in Section 10).
The EA strategy involved finding effective ways to manage flood risk in the estuary and in particular the stretch from South Gloucestershire to Hinkley Point, Somerset. Flooding is a natural process, but one that can have a major effect on people, communities, the economy and the environment. Whilst the EA state that they cannot prevent all floods, as part of their flood risk management planning, they can prepare for them and reduce their likelihood.

The strategy indicates that for the 50,000Ha Severn Estuary Study Area there are approximately 250,000 residents and £14 billion of important infrastructure at risk.

The document explains the approach the EA takes for gauging the best approach to reducing the risk of flooding these assets and sets out with the aim of how these policies turn into appropriate action.

**Figure 4-2 Extract from Severn Estuary Strategy 2011 – Aust to Avonmouth**

For the study area, the strategy indicates that the railway line will provide an adequate defence until 2060. If the line has not been raised by 2060 a second line of defence will be constructed behind the railway, maintain the 1 in 200 year standard. The port extension will have a positive effect on flood risk but other improvements in the port will be necessary to maintain an adequate defence.
4.5 Local Context

Flood risk should also be set in local context by the Strategic Flood Risk Assessment (SFRA) for the Avonmouth/Severnside area.

4.5.1 Avonmouth/Severnside Level 2 Strategic Flood Risk Assessment, 2010

This Strategic Flood Risk Assessment (SFRA) is intended to provide flood risk information to strategic planners during the land use allocation process, to assist with development control decisions and also inform the wider community in matters relating to development and flood risk in the Avonmouth / Severnside area.

A Level 1 (initial assessment) SFRA was completed in 2007 which looked into the Avonmouth / Severnside area. In 2011, a (more detailed) Level 2 SFRA for the area was produced by Capita for Bristol City and South Gloucestershire Councils. It describes how the Level 2 SFRA is used to inform the application of Planning Policy Statement 25 – Development and Flood Risk (DCLG, 2010).

The guidance contained within PPS 25 requires a sequential risk based approach to decision making at all levels of the planning process. The SFRA represents the local level, whilst site specific FRA represent the site level (for planning applications).

The SFRA is a local strategic framework to provide guidance at the local level. The SFRA provides information on the current flood risks in the area and how these are likely to change in the future. The main objectives of the SFRA are:

- To provide ‘the evidence base for the application of the risk based sequential approach, including assessing site allocation within flood zones’
- To ‘support planning decisions through the assessment of all sources of flooding’
- To provide strategic support ‘as it covers a wide spatial area, considering both present and future risk’
- To ‘support sustainability appraisals and local development documents by informing local policy decisions and the requirements to satisfy the Exception Test’
- To identify what further investigations may be required in flood risk assessments for specific development proposals; and
- To ‘inform decisions on local emergency planning with respect to flooding’

The guidance and findings have been considered and extensively used in the preparation of this report. Where the document is quoted verbatim, the text is italicised.

Crucially, in respect of the sequential and exception tests, the SFRA in paragraph 8.18 states:

*An extended flood zone 3a policy is recommended for the breach hazard bandwidth. In addition to the standard flood zone 3a requirements the extended policy should require an Exception Test for all types of development within the breach hazard bandwidth and should also limit development to water compatible and less vulnerable development types only. At all locations at risk of breach (including those outside the defined bandwidth) FRAs will need to assess the risk of breach in more detail and also consider mitigation within the design of the building.*
In this report, we have assumed that this recommendation will be taken forward by the commissioners in preparing policies as part of their Local Development Framework (including their Core Strategies).

The SFRA was published in March 2011 by the joint commissioners, Bristol City Council, South Gloucestershire Council and the Lower Severn Drainage Board.
5 Consideration of Flood Risk

5.1 Avonmouth/Severnside Strategic Flood Risk Assessment (SFRA)

The SFRA identifies a requirement for strategic responses to flood risk in the Avonmouth / Severnside area to enable new development in accordance with PPS25. The study identified that, over time and without improvements to the existing tidal defences in particular, the extent and frequency of flooding will become worse. Decisions taken on land use will need to recognise the potential severity of the consequences and the appropriate ways of responding to the risk. Fluvial flood risk is also a determining factor.

The study showed that the tidal flood defences within the study area are to a variety of standards with a range of conditions from poor (and in need of repair) to excellent (i.e. all EA condition grades 1 to 5).

The plan (Figure 5-1) and table (Table 5-1) below shows both the location of the tidal wall zones that were adopted for the tidal flood defences assessment as part of the SFRA (February 2011) and the summary of the condition grade assessment. Figure 5-1 Tidal Wall Zones (Reproduced from the SFRA Figure 4.0)

Note: The SFRA study area shown extends beyond the study area of this report. Further study is required to confirm that the defence of the study area only relies on defences within this study area.

<table>
<thead>
<tr>
<th>Section</th>
<th>Type of Structure</th>
<th>Status</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>D – E</td>
<td>Raised Foreshore</td>
<td>Private / De Facto</td>
<td>Good</td>
</tr>
<tr>
<td>E – F</td>
<td>Raised Railway Embankment</td>
<td>Private / De Facto</td>
<td>Good</td>
</tr>
<tr>
<td>F – G</td>
<td>Raised Earth Embankment</td>
<td>Formal EA defence</td>
<td>Good</td>
</tr>
<tr>
<td>G – H</td>
<td>Rock Armour and Raised Earth Embankment</td>
<td>Private / De Facto</td>
<td>Good-Fair</td>
</tr>
<tr>
<td>H – I</td>
<td>Rock Armour, Pipework and Block Wall</td>
<td>Private / De Facto</td>
<td>Fair</td>
</tr>
<tr>
<td>I – J</td>
<td>Rock Armour and Small Ballast Bund</td>
<td>Private / De Facto</td>
<td>Fair</td>
</tr>
<tr>
<td>J – K</td>
<td>Lock/ Dock Gates</td>
<td>Private / De Facto</td>
<td>Fair</td>
</tr>
<tr>
<td>K – L</td>
<td>Rock Armour, Sea Wall and Earth Embankment</td>
<td>Private / De Facto</td>
<td>Poor</td>
</tr>
<tr>
<td>L – M</td>
<td>Rock Armour (Rubble) and Earth Embankment</td>
<td>Private / De Facto</td>
<td>Poor</td>
</tr>
<tr>
<td>M – N</td>
<td>Raised Earth Embankment</td>
<td>Private / De Facto</td>
<td>Fair</td>
</tr>
</tbody>
</table>
The tidal defence assessment completed as part of the SFRA highlighted that some defence sections are of unknown or non-standard construction, and therefore may have a high chance of breach or failure. The overall existing standard of protection is unknown as many of the defences are “informal” and are not maintained by the riparian owners.

The SFRA breach modelling results show that failure of the defence in the future case (2110), could lead to severe flooding across virtually the whole study area (with flood depths in excess of 2 to 3 metres). Nearly all of the study area would be affected with its supporting infrastructure inundated. Even where raised site levels have been provided on development sites, safe access and egress may not be possible.

<table>
<thead>
<tr>
<th>Section</th>
<th>Type of Structure</th>
<th>Status</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>N – O</td>
<td>Brick Wall</td>
<td>Private / De Facto</td>
<td>Fair</td>
</tr>
<tr>
<td>O – P</td>
<td>Raised Earth Embankment</td>
<td>Private / De Facto</td>
<td>Fair</td>
</tr>
</tbody>
</table>

**Table 5-1 Tidal Flood Defence sections (Table 4.1 SFRA)**

Note: Sections A-C lie outside this study area.
The study area’s future standard of protection from the existing tidal flood defences is less than 1 in 200 years. Refer to Figure 5-2.
Figure 5-2 Actual Risk Future Case 1 in 200 year Tidal, 1 in 2 year fluvial (SFRA Fig 7.3)

The modelling of the Actual Risk Future Case scenario shows that only higher ground levels around Avonmouth village are outside the EA flood zones 2 and 3.

The consequences of the current situation modelling include:-

- Overtopping of the tidal defences as a result of lengths of low standard of protection
- Overtopping due to sea level rise associated with effects of climate change
- Rapid inundation from a breach of the tidal defences of very high flood levels

The SFRA modelling indicates that:

> "the level of protection provided by the defences is likely to reduce significantly in the future due to the effects of climate change, principally increases in sea level and increased ‘storminess’ and wave overtopping. If defences are not improved, the frequency and severity of flooding in the future is such that existing and planned development is unlikely to be sustainable. The SFRA findings demonstrate that there is a need to upgrade the defences (both condition and design standard) to sustain proposed development."

Importantly the SFRA noted that a:

> “HTL (hold the line) policy as recommended by the Shoreline Management Plan (SMP) does not guarantee funding for defence maintenance and / or capital works along these sections of the shoreline but it is expected there will be a commitment to implementation of Shoreline Management Plan policy.”

Due to the potentially high flood hazard posed by a breach in defences in the study area, the SFRA has identified a breach hazard bandwidth as an additional flood zone – refer to Figure 5.3. This represents the area in which particularly high velocities and speed of inundation would be expected during a defence breach. This zone extends across a significant strip almost 2kms wide inland from the shoreline, encompassing a significant part of the study area.

Whilst there is a high potential for flooding from tidal sources through overtopping or breach of the defences, there is also the risk of flooding to some parts of the study area from fluvial sources, such as the rhyne river network that flows northwards from the east of the study area between Avonmouth Village and Halstead to Pilning and beyond.

The SFRA makes the following key recommendations:

- The defences protecting Avonmouth / Severnside are of varying design and few construction and condition details are available. BCC / SGC, with the Environment Agency, should consider formalising the responsibilities and maintenance regime for the defences. This should provide improved certainty in the level of protection provided now and in the future.
This could be achieved by establishing a riparian owner group to jointly assess and upgrade their defences to an acceptable standard in accordance with an agreed strategy; Passing legislation that enforces the riparian owners to assess and upgrade their defences to an acceptable standard in accordance with the agreed strategy.

- Given the scale of flooding anticipated in the future, a strategic approach to flood risk mitigation is recommended over site specific mitigation and a flood risk strategy should be jointly developed.

This is the key outcome from this strategic study

- Improvements to the tidal defences is a key component of the management of flood risk on the Avonmouth / Severnside area; 
- Flood incident management and emergency preparedness will be key to reducing risk to life and property in a defence breach situation; 
- The effectiveness and feasibility of residual flood risk mitigation options and their impacts on flooding elsewhere needs more detailed investigation, particularly the flood risk associated with wave overtopping taking account of joint probability and the impact of land raising and raised access routes on flooding to existing development and property.

This work would form part of a feasibility study into the preferred strategic option

- An extended flood zone 3a policy is recommended for the breach hazard bandwidth – see Figure 3-1 below. In addition to the standard flood zone 3a requirements, the extended policy should require an Exception Test for all types of development within the breach hazard bandwidth and should also limit development to water compatible and less vulnerable development types only.

Should a strategic option not be brought forward the L2SFRA recommended that a strip of vulnerable land (approx. 2km wide – see Figure 5.3) be designated a “breach hazard bandwidth” to highlight the increased level of risk in this location
5.2 Shoreline Management Plan

The Shoreline Management Plan (SMP) sets out the future coastline strategy and was established in 2000 – it looks purely at tidal flooding. A comprehensive review was undertaken in 2009 and was adopted at the end of the 2010. The SMP framework informs the strategy for Avonmouth/Severnside in order to create an integrated implementation strategy for the area.
The Severn Estuary Shoreline Management Plan (SMP2) states that the short term (0-20 years) policy to 2030 adopted in relation to the defences is **Hold the Line** (HTL). This will mean repairing or replacing defences in the same place as they currently exist if a more cost effective option cannot be selected.

The SMP suggests that there are two ways in which HTL may be implemented:

- Maintaining the same standard of protection (SoP) as today – this would keep the existing standard of defence, but with rising level (topographic) ensuring flood defences were repaired but only to the same SoP as today;
- Not increasing the height of defences so that the SoP gradually decreases – the existing topographic level of defence would remain but with the effects of climate change the standard would decrease. It is unclear from the reporting what the SoP offered by 2031 would be.

This policy would mean that the Avonmouth/Severnside area would be protected to a gradually decreasing standard over time due to the effects of climate change.

It is unclear what happens in the event of funding not being available to support this policy. However, the SFRA reported that the Severn Estuary Flood Risk Management Strategy (SEFRMS) aims to consider the HTL policy in more detail, although there is no timeframe for resolving this.

### 5.3 Catchment Flood Management Plans (CFMP)

The study area covers two CFMP areas which unlike the SMP look purely at fluvial flooding. The adopted CFMP policy for the study area is: ‘**Areas of low, moderate or high flood risk where we are already managing flood risk effectively but where we may need to take action to keep pace with climate change**’. Whilst CFMPs are primarily aimed at management of fluvial flooding, the drivers behind selection of the policy will also apply to tidal flooding. Identified actions, relevant to the study area, to implement CFMP policies include:

- “Carry out a multi-agency review of flood risk management led by the Environment Agency and involving South Gloucestershire Council and the Internal Drainage Board” (Severn Tidal Tributaries CFMP);
- “Maintain flood warning systems and explore opportunities to improve how effective they are and increase the number in place” (Severn Tidal Tributaries CFMP);
- “Improve the public’s awareness of the risk of flooding and what to do when they receive a flood warning” (Bristol Avon CFMP); and
- “Review maintenance operations to make sure they are proportionate to flood risk” (Severn Tidal Tributaries CFMP).
5.4 Climate Change

The effects of climate change are likely to increase the incidence of tidal flooding due to sea level rise. Climate change impacts will mean that there is a long term increase in the average sea levels in the adjacent estuary; predicted to be a 1m increase over the next 100 years (approximately 4mm per year rise for this region – see PPS25 Table B1 for guidance). Assuming that no changes are made to the existing banks or walls that protect the land from flooding the long-term increase in sea levels means that the flooding in the future will be both more frequent and more severe than at present. Further study is required in order to quantify how much more frequent and severe flooding will be, but the SFRA has reported that the likelihood of significant wave overtopping and the risk of breach of the existing defences will rise.

The SFRA comments that “in the future, the extent of tidal flooding is predicted to include much of the low lying land (within the study area). Compared with the present day, the extent of flooding for more extreme events only increases slightly because of the steep edges of the floodplain. However flood depths are shown to increase significantly;”

5.5 Flood Risk and Developable Land

Previous papers and studies reviewed as part of this study have drawn on a considerable amount of detailed hydrological and mathematical modelling and have established from a technical standpoint what is required to “Hold The Line” and the effects of climate change. The plans outlined in Appendix B show the resulting predicted flood extent.

The plan shown in Appendix C (Plan 07) illustrates the study area and the areas of greenfield land that might be suitable for future development. These areas have been identified following the review of the constraints that affect the area, including flood risk. The SFRA highlights flood risk across the study area from tidal and fluvial events; it is clear that the site is (and will remain) at significant risk of tidal flooding unless sea defences are improved.

At present, the following is occurring:

- In South Gloucestershire, there is the continued build out of the 57/58 permission and some redevelopment of previously developed land. The developers of the land covered by the 57/58 permission are raising land levels to mitigate the risks of flooding from tidal and/or fluvial sources. This is without consideration of the impact of such land raising on adjacent sites, albeit with the incorporation of some SuDS measures to improve surface water runoff performance.
- In the Bristol City area, there are proposals coming forward to develop previously developed land, although there has been some green field development within this area too.
- The Port’s proposals to redevelop and extend their site with a new deep sea terminal incorporate a substantial defence at a proposed level of 10.67m AOD that will protect the south western end of the
study area. Should this not come forward any scheme that is proposed for the whole study area should incorporate a defence for the port area to ensure the complete flood cell is incorporated.

The approach being taken on other previously developed sites within the study area (outside the 1957/58 consent area) appears to be that the local planning authorities are, in consultation with the Environment Agency, granting permissions for new development on a site by site basis, raising the finished floor levels of buildings and finished levels of external areas and providing compensatory flood storage in close proximity to or within the sites.

It is evident that the Environment Agency, as set out at the Bristol City Council’s Core Strategy examination, is likely to object to new applications for the continued redevelopment of previously developed land within the study area, where such proposals are brought forward on an ad hoc basis in the absence of a strategic flood risk mitigation solution for the wider area, and this has been confirmed in correspondence. The EA has limited powers to intervene in development covered by existing consents (1957/58 particularly)

The SFRA identifies the 10.74m AOD defence as a potential optimum solution to tidal flood risk in the area. Providing a higher defence level would give added protection against overtopping and reduce the likelihood of breach, but it would come at a high financial and environmental cost.

The Bristol Port, as part of the Deep Sea Container Terminal development within the south west of the study area is implementing proposals to provide a 10.67m AOD quay wall (up from the existing 8.5-9m AOD), scheduled for construction in 2015. However, the Port’s Terminal works do not include the replacement of the Avonmouth Dock Defences, particularly the lock gates. The Environment Statement for the scheme indicates that “the gates do not form a functional part of the existing defences due to their current design height restrictions”, whilst the “tie-in embankment levels adjacent to the lock gates are at an average of 10.2m OD.” These defences are owned and maintained by Bristol Port Company.

In addition to these scheme works, further mitigation measures should be brought forward (e.g. raising the lock gates and raising land levels for buildings) to deal with risks from wave overtopping and breach where appropriate. Some of this mitigation may require the Environment Agency’s Compulsory Purchase Order powers because it will affect land in private ownership.

5.6 Phasing

Current consultation with the EA has suggested that a strategic solution might be developed in stages, behind the railway line or by raising the railway line and converting the embankment into a formal flood defence. Indeed, this type of option is discussed in the SFRA. A phased strategic solution would provide flexibility in the funding stream and would allow some planned redevelopment of previously developed land within the study area if it could be made to work from a technical and cost basis. This could proceed in advance of a strategic solution coming forward for the entire study area, provided it fitted within the strategy framework.
There are examples of flood defences having been deployed in phases with appropriate materials and methods of ensuring structural integrity of the finished defence. Further work will be required during the next stages to detail whether phased defences can be delivered in a cost effective manner.
6 Intervention Options

6.1 General
There are four principle options that are available as part of a flood defence strategy to help further develop the Avonmouth/Severnside area. These are described below and could incorporate flood defences either on the existing defence, or behind the railway line or by raising the railway line and converting the embankment into a formal flood defence. A combination of these options could also provide a preferred option.

Any scheme should include freeboard allowances that would account for uncertainty in the modelling or engineering factors such as settlement over time.

6.2 Intervention Options

Do Nothing – Exactly that, no expenditure on flood defence works or maintenance activities ignoring whether this is legally possible;

Do Minimum – A continuation of the existing status quo, with flood defence maintenance works and inspections continued to ensure statutory duties maintained.

The SFRA states “It is recommended that BCC / SGC, with the Environment Agency, consider formalising the responsibilities and maintenance regime for the defences that provide protection to Avonmouth / Severnside. This should provide improved certainty in the level of protection provided now and in the future.”

More investigation is required to define how this could be achieved.

Do Minimum Plus – A continuation of the existing status quo, with landform raising through approved planning applications for developments and the provision of surface water SuDS. The raising of key highway routes for safe dry access/egress would be included in this option.

With Scheme 1 – A higher level of flood defence as defined in the SFRA (10.74mOD) that could allow some development including flood risk improvements to the rhyne network to reduce the risk of fluvial flooding to the area. The scheme would be designed to protect Avonmouth against the risk of overtopping and breach to the year 2110 for the 1 in 200 year still water event allowing 0.5m freeboard.

With Scheme 2 – A higher level of flood defence as defined in the SFRA (12.40mOD) that could allow development including improvements to the rhyne network that will reduce the risk of overtopping and breach to the year 2110. The scheme would be designed to protect Avonmouth against the risk of overtopping and breach to the year 2110 for the 1 in 200 year still water event allowing 1.16m to reduce the effects of overtopping of the defences, also with 0.5m freeboard.
6.3 Mitigation Measures

The SFRA investigated a number of other potential strategic mitigation measures over and above the intervention options, defined in 6.2 above, as part of the Level 2 SFRA. The assessment was carried out dividing the study area in to eight strategic zones defined on areas with similar flooding mechanisms, development characteristics and to fit with the flood defence typology. The mitigations were chosen to increase the standard of protection and accommodate the anticipated effects of climate change.

- Change of land use
- Strategic land raising
- Recommendation of local scale land raising on a plot by plot basis
- New / improved access routes
- Property resilience / resistance measures
- Flood warning / flood event management
- Improvements to the Rhine network (local & strategic)

The assessment indicated that unless properly designed and mitigated, large scale land raising or provision of raised access routes could significantly increase the impact of flooding to existing development, especially in the event of a defence breach – up to a 300mm rise in flood level was reported in the SFRA. It may be necessary to consider alternative solutions, including raised buildings with voids or stilts; elevated roads on viaducts, and limiting the area of land raising to within preset controllable levels. Such structures would need to be designed to withstand the predicted flood depths and velocities.
7 Costs and Benefits

7.1 General

In order to assess the merits of the various options the financial and non-financial costs and benefits for each option should be defined. The key scheme elements have originated from the SFRA, which have been developed using a series of design standard details and cost rates per metre of flood defence repair or renewal and where appropriate complete reconstruction inside or outside the existing line of defences.

The SFRA used the built up rates and applied preliminaries and contingencies with 60% Optimism Bias as Treasury Green Book requirements and subsequently then inflated to February 2011 prices. Tables 7.1.1 and 7.1.2 below show the summary table from the SFRA.

We have not sought to develop different cost estimates, bearing in mind the recent publication of the SFRA and the lack of any detailed proposals for improving the area’s flood defences. Further cost analysis will be required following the development of detailed and specific proposals for mitigating flood risk in the area.

The following table splits out those elements that were included in the SFRA but that are outside the remit of this study – in particular the Binn Wall and the flood defences to the north. For comparison the Total for the SFRA 10.74mAOD scheme is £56m. It should be noted that whilst the various lengths of existing flood defence have been separated, in reality the whole study area acts as a single flood cell and any flood risk management scheme would have to be implemented in unison. Refer to Figure 5-1 for a plan of the SFRA scheme sections and corresponding CSL (Capita Symonds Ltd) references.

An option has been shown that includes and excludes the Bristol Port defences and lock gate infrastructure. It is anticipated that these items will be developed by the Port as part of their proposals to develop a new deep sea container terminal.

7.1.1 Tidal Scheme Costs with Bristol Port and Lock Gates

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</tr>
<tr>
<td>7</td>
<td>H-I</td>
<td>400</td>
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### 7.1.2 Tidal Scheme Costs without Bristol Port works or lock structure

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<td>40</td>
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<tr>
<td></td>
<td>M-N</td>
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7.1.3 Fluvial Costs

There is no evidence of proposals to mitigate the risk of fluvial flooding in the area or costs for any such mitigation in the literary review. Further detailed work is required to bring forward rates and build-ups for schemes with various standards of protection for inclusion with the tidal schemes.

Figures included within section 7.2 have been estimated based on engineering judgement, but should be confirmed as part of a further study that will need to identify the impact of fluvial flood risk on the area and proposals for mitigating that risk.

7.2 Cost Summary

The following cost summary can be drawn from the various schemes and options that have been brought forward from the literary review:

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Scheme standard</th>
<th>Cost</th>
<th>Notes</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Tidal</td>
<td>Fluvial</td>
</tr>
<tr>
<td>Do Nothing</td>
<td>Existing SoP but reduces</td>
<td>£0</td>
<td>£0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No scheme expenditure</td>
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over time

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<tr>
<th></th>
<th>Existing SoP maintained</th>
<th>£0.5m</th>
<th>£0.2m</th>
<th>Maintenance and inspection duties only with no allowance for climate change</th>
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<tr>
<td><strong>Do Minimum</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Do Minimum Plus</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>With Scheme 1</strong></td>
<td></td>
<td>£43m</td>
<td>£3m</td>
<td>Tidal and fluvial costs are for improvement works to existing defences or new defences where required to reduce risk of rising sea water levels. This cost includes works to the port lock gates and tie-in structures</td>
</tr>
<tr>
<td><strong>With Scheme 2</strong></td>
<td></td>
<td>£280m</td>
<td>£4m</td>
<td>Tidal and fluvial works to bring flood defences up to 12.40m AOD to minimise effects of overtopping and breach. This cost includes work to the port lock gates and tie-in structures</td>
</tr>
</tbody>
</table>

Source – L2SFRA Capita (Section 4.6.3.37)

**7.3 Phasing**

The phased implementation of a strategic solution for flood risk mitigation of the Avonmouth/Severnside area should to be considered carefully, as whilst this may be more attractive and give access to potential funding, it may not be possible to deliver the scheme in discrete lengths of works, as the defences may become outflanked by flood water. However, if the scheme was implemented based on the phased raising of design height with intervention at certain times in the design life of the scheme, then a phased approach may provide value.

It should be noted that the total strategic solution would be required to be implemented before the scheme provided the required standard of protection.

The possible phasing of the flood defence works should be subject to further study and the relative merits of this approach should be fully understood. Included within the scope of this study should be the relative cost/value analysis of improving the existing flood defences by refurbishment/extension of the existing defences set against building new flood management measures.
8 Risks and Mitigation

The key risks to any strategic solution from a flood risk perspective can be summarised under the general headings as follows:

8.1 Funding stream not guaranteed

Funding for a flood defence scheme to increase the standard of protection provided to Avonmouth/Severnside may be possible in part through Defra Grant in-aid funding. Schemes will be subject to appraisal and assessed based on a robust cost-benefit analysis using the HM Treasury Green Book (2003) methodology.

However, from a National perspective there are many pressures on these funds, particularly now that the grants have been reduced. The scoring system to assess the priority on a National basis, is weighted towards protecting the most residents, or businesses for the least capital cost. Whilst the SMP documentation highlights the fact that benefits for a scheme in the area are significant resulting from offsetting damage to residential and business property, the environment and infrastructure, the likelihood of gaining Defra funding is remote for a scheme with such high capital value. For Defra funding to be granted, it will be necessary to establish a highly cost beneficial case around the protection of the businesses and homes within the Avonmouth / Severnside area. This should be the subject of a separate study and in particular the damage and hence economic benefit that such a scheme would provide.

There are other means of attracting funds such as contributions from significant new development or by developer contributions.

Also, levies imposed by the Environment Agency on Local Authorities, and by the Local Authorities themselves could be used to raise the necessary funds for capital works. The local levies are raised by a committee from local authorities at the request of a regional flood defence committee and used to fund flood risk reduction and resilience projects that would not otherwise be eligible for national funding.

The Community Infrastructure Levy was introduced in April 2010. The main report by WYG deals with the possibility of funding from Section 106 agreements/CIL for the development of land within the study area.

Funding of strategic flood defence improvements is therefore the principal factor for the progression of a strategy.

8.2 Fluvial Risk

In order for flood risk to be adequately managed including the effects of climate change, not only the tidal risk but also the fluvial risk from the Rhyne network should be managed. A scheme of works, to be approved by the Lower Severn Drainage Board, should be prepared and brought forward to ensure that future development in the key 57/58 consent area does not jeopardise the availability of channel capacity or compensatory storage elsewhere within the study area.
The nature, extent and cost of any scheme would need to be investigated, including how the project could be funded.

8.3 EA Objection to New Development

The EA have indicated that they are likely to object to new development in the Avonmouth/Severnside area until a strategic plan is implemented with detailed design and a funding stream in place.

The EA is currently considering development proposals within the study area on a scheme by scheme basis and the broad approach of developers to date has generally been to incorporate measures to mitigate tidal flood risk on site to address the EA’s concerns. Such measures often comprise elevating the finished floor levels of new buildings. However, the EA is concerned that such an approach will, on a cumulative basis, potentially increase the risk of flooding elsewhere within the study area. The EA therefore wishes to see a comprehensive solution brought forward to mitigate the risk of flooding to new and existing development in the study area.

In the context of the SFRA, the EA is likely to object to new “greenfield” development within the study area that is not covered by the extant 57/58 or other planning permissions, unless such development addresses the tests in PPS25. On “brownfield” sites, the EA is also likely to object to development proposals in the future unless a comprehensive package of measures is brought forward to address flood risk in the study area.

8.4 Land ownership

Land ownership and the availability of the various land parcels that are required for a flood risk strategy that will enable continuing economic development in the study area.
9  Recommended Way Forward

9.1  General Recommendations

The existing risk of flooding of the Avonmouth/Severnside study area is significant. The principal flood risk is from tidal flooding due to defences that are in variable but generally poor condition. The risk from fluvial flooding is also apparent across significant parts of the study area.

It is anticipated that if the existing flood defences are not improved, with the frequency and severity of flooding in the future due to the effects of climate change, existing and planned development is unlikely to be sustainable on the Avonmouth/Severnside study area. The area is severely at risk from flooding, primarily from tidal breach and overtopping, but also from fluvial flooding from the rhyne system. The recently published SFRA findings demonstrate that there is a need to upgrade the defences that are generally in poor condition and have a low but also variable standard of protection, to sustain any proposed development. This is in alignment with the Severn Estuary Shoreline Management Plan Review that states that the short term (0-20 years) policy adopted in relation to the defences is Hold the Line (HTL).

From a planning perspective PPS25 is clear in that new development of the Less Vulnerable type (Offices, warehouses etc.) in Flood Zone 3a need not be accompanied by a Sequential Test and there are some limited pockets of this flood zone in the study area. PPS25 states that Flood Zone 3b requires a Sequential Test, which should be addressed for any greenfield or brownfield allocations i.e. show there are no other suitable sites in Flood Zones 1 or 2 before allocation of land in Flood Zone 3. However, the recently published SFRA has recommended that in addition to applying the Sequential Test, properties within the study area's breach hazard bandwidth (see plan in Figure 5-3) should be subject to an Exception Test. Where greenfield land in the study area hasn't already been allocated in a Local Development Document, it will become difficult to bring it forward for (re)development due, in particular, to the application of the Exception Test, which requires amongst other criteria, for the development to be on previously developed developable land.

The EA is, in the context of the SFRA, likely to resist development (on greenfield and brownfield sites) within the study area unless a strategic flood risk solution is seen to be forthcoming. That’s because with climate change, flood risk is increasing and an ad-hoc site-by-site approach only increases flood risk to others. However, if a strategic flood risk solution were identified, the redevelopment of brownfield land could be progressed within the study area, in accordance with planning policies, provided the “Exception Test” was satisfied.

With regard to the development of greenfield land within the study area, even with a strategic tidal defence solution in place, a sequential approach will be required as the area will still be in flood zone 3a. The sequential test will be likely to show preference to brownfield and greenfield sites out of the study area in flood zones 1 and 2, unless the development is specific to port related uses. Some development sites that have been put forward
for development are outside the breach hazard bandwidth and may therefore proceed without an Exception Test.

The EA would like to see a strategic solution implemented, either with phased improvements on the existing defence alignment, behind the railway line or by raising the railway line and converting the embankment into a formal flood defence. A phased strategic solution would provide flexibility in the funding stream and would allow some planned redevelopment of previously developed land within the study area.

Bristol’s recently adopted Core Strategy proposes only the redevelopment of existing brownfield land and indicates that additional Greenfield land will not be allocated for development in the study area during the plan period.

With regard to the 57/58 consented land parcel it is inevitable that further land raising in this area is likely and that it needs to be integrated and “planned” into any future development scenarios and flood risk mitigation strategies.

9.2 Recommended Further Study

There is a great deal of synergy for this region between the strategic flood risk assessment and the shoreline management plan as the drivers are consistent. However, the risk of fluvial flooding should not be overlooked and further study on fluvial mitigation measures is required in order to define solutions to sustainably reduce flood risk. Critically, it should be confirmed that this study area acts on its own and is not out-flanked by other flood cells to the north.

Further work is also envisaged by the Environment Agency which has indicated during this study that the following areas should be investigated in order to add detail to emerging strategies: joint wave/tide assessment, ground conditions assessment, land ownership and defence crest height requirements.

In order to attempt to attract Defra funding a damage assessment study will have to be undertaken in accordance with the Flood Hazard Research Centre Multi-Coloured Manual to establish the benefits of fully costed schemes.
10 References

3. Strategic Flood Risk Assessment Avonmouth/Severnside (Level 2), Capita Symonds (final) December 2010;
4. Strategic Flood Risk Assessment Avonmouth/Severnside (Level 1), Capita Symonds (final) 2007
Appendix A – Existing Site Plan
Appendix B – 1 in 200 year Existing Flood Extent
Appendix C – 1 in 200 year Climate Change 2105 Flood Extent
Appendix D – Developable Land showing Breach Hazard
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author  Pablo Izquierdo

signature

date  24/06/2011

approved  Anthony Davies

signature  By email.

date  24/06/2011
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1 Executive Summary

This study discusses the energy related opportunities that could unlock the potential of the Avonmouth/Severnside study area as part of the WYG-led team that is developing an integrated development strategy for the area on behalf of SWDRA, Bristol City Council and South Gloucestershire Council.

Following a description of the low carbon energy framework at international and national level and a description of the relevant regional policies, an assessment of the low carbon energy opportunities in the area has been carried out based on previously published reports and information on the study area. The assessment concludes that, with the exception of wind, solar technologies (photovoltaic and solar hot water) and energy from both wet and solid waste, no other renewable or low carbon technologies could make a significant energy contribution to the study area. In particular, energy recovery facilities using municipal solid waste or non-local biomass offer the largest low carbon energy opportunity for the study area. This study discusses how this energy could act as a catalyst to unlock the area’s potential if it was made available locally, particularly in the case of heat that would have to be distributed through a distribution network as opposed to electricity that could be transported through the national grid and used elsewhere.

A detailed review of the drivers and barriers for installing a district heating in the area highlights that there are very important national targets and regional strategies that, because of the economic and environmental benefits associated to it, support its implementation. Conversely, the economic and technical risks associated with the funding, design, build and operation of a district heating network, are the most important barriers. At the same time, the presence of large heat sources in the area, e.g. energy recovery plants, presents an opportunity for the network. However, the current and forecasted building use mix, that results in a very low heat demand density, and the introduction of more stringent building regulations, that requiring new buildings to have lower CO₂ emissions thus lower energy demands, mean that the energy demand may even be lower in the future.

Therefore the only area where the installation of the network will be currently justified is in the land not yet developed within the 57/58 permission area. Nonetheless, and because of the opportunity that a district heating network has to unlock the whole study area potential and bring economic and environmental benefits to it, a possible layout for the district heating has been proposed and supported by a feasibility statement for the best case scenario. A list of the existing and proposed heat generation plants and large heat consumers, i.e. anchor loads, has also been produced together with the network phasing. It has been proposed to start the network in the South of the study area, where there is a concentration of large heat generators and users, and then expand it to the North; where the Viridor energy from waste plant has just been granted planning permission and the 57/58 planning consent area, that presents the best opportunity to install a district heating network because of its high heating demand density, are. The feasibility assessment includes a capital cost estimation of £30m that could be recovered, in a best case scenario, in a period of 19 years with a discount rate of 6%.
Finally, this energy study concludes with some recommendations for the Bristol City Council and South Gloucestershire Council that include:

- To commission a market study to assess the interest of companies with high potential heating or cooling loads in getting established or relocating to the study area to establish and support the feasibility of the district heating network.

- To commission a market study to assess the interest of companies with high heating or cooling loads to relocate to the study area to increase the feasibility of the network.

- To carry out a detailed feasibility assessment of the district heating to validate and test the sensitivity of the assumptions and the results as well as to refine the layout and phasing proposals presented in this energy study.

- Assuming the feasibility of the network is proven, to engage an energy services company to share the funding, designing and building the network as well as to operate, maintain and manage the network.

- To make use of the policies incorporated in the Bristol and South Gloucester core strategies to:
  
  - Support the best low carbon energy opportunity for the area represented by the district heating network;
  
  - Explore the potential mechanisms for developers to contribute to the developments of an area by using planning obligations or a Community Infrastructure Levy that could be used to help fund the district heating network;
  
  - Apply the heat strategy described in the policies; and
  
  - Discuss in every planning application in the study area the possibility to connect to the proposed district heating network or to justify otherwise.
2 Introduction

Buro Happold has been commissioned to study the energy related opportunities that could unlock the potential of the Avonmouth/Severnside area as part of the WYG-led team that is developing an integrated development strategy for the area on behalf of SWDRA, Bristol City Council and South Gloucestershire Council.

The strategic importance of the area has been acknowledged by both Bristol City and South Gloucestershire Councils. This has been expressed in a draft joint vision statement that sets out the key characteristics of the area to 2050:

"An internationally significant industrial location, home to world-class companies operating in key sectors which are at the heart of the UK’s economic future, including advanced engineering, green and environmental technologies, tidal power and transport and logistics.

Business will be drawn by investment opportunities and a reputation for innovation, competitiveness and superb infrastructure including a deep-water container terminal providing direct access to road and rail networks from the closest port to the UK population with 45 million people living within 300 kilometres.

Through a positive approach to development planning and public investment in infrastructure that will unlock the area’s full potential, Avonmouth and Severnside will provide up to 7,500 new jobs helping to drive forward Bristol and the West of England as the UK’s most competitive city region, generating a wide range of jobs and significant local economic benefits."

This future role of the area is challenged by:

- A lack of infrastructure to distribute locally generated energy, e.g. energy from waste plants, back into the local area;
- Close proximity but limited connectivity to the national motorway network;
- The 1957/58 planning consent for a large part of the study area that allows a potentially unconstrained development, resulting in limited public sector leverage to realise infrastructure improvements through the development control;
- An increasing risk of large scale catastrophic flooding; and
- Proximity to nature conservation areas of European significance.

The local Councils and other agencies recognise the need for an integrated approach to identify how best to tackle these issues in order to protect existing investment, manage and protect the natural wetland resource and realise the opportunities that arise from a long term planned approach to future development and infrastructure provision to 2050.
This energy study describes the site, reviews the applicable energy policies at international, national, regional and local level and discusses the energy opportunities that could unlock the potential of the area so that they can be integrated with the wider development strategy being prepared by the WYG-led team.

2.1 Site description

The site is located to the North East of Bristol and is bounded to the West by the Severn Estuary, the M49 to the North and East and the river Avon to the South as shown in Figure 2—1.

![Figure 2—1 Site location.](image)
3 Low carbon energy framework

This section reviews the applicable international and national legislation and policies that define a low carbon energy framework where a potential district heating network for the study area would fit.

This section also presents an extract of the regional core strategies that outline some of the drivers and opportunities at a regional scale which will be explored in detail for the study area in the next section.

3.1 International level

3.1.1 EU Renewable Energy Directive.

This European Union (EU) directive requires the UK to generate 15% of its energy from renewable sources by 2020 and according to Department for Energy and Climate Change (DECC), this could mean that more than 30% of the UK’s electricity and 12% of our heat should be generated from renewable energy sources. Some of the developments in the study area already generate renewable electricity and a district heating network will enable the distribution and use of renewable heat.

3.2 National level

3.2.1 The Climate Change PPS and PPS 22: Renewable Energy

The Climate Change PPS is a supplement to PPS1 and was published in December 2007 to highlight climate change considerations in the planning system.

The Climate Change PPS sets out how the Government expects planning to help deliver its ambition on zero carbon development and shape sustainable communities to be resilient to climate change. The PPS also requires local planning authorities to prepare and managed the delivery of decentralised renewable and low carbon energy strategies aligned with the Government’s Climate Change Programme and energy policies.

PPS 22 requires local authorities to enable renewable energy developments throughout England in locations where the technology is viable and environmental, economic, and social impacts can be addressed satisfactorily. Therefore, creating a district heating network in the study area, subject to the detailed analysis of its environmental, economic and social impacts, will be clearly aligned with the PPS 22.

3.2.2 The UK Renewable Energy Strategy 2009

This strategy sets out how the UK will generate renewable electricity, heat and transport fuels to meet the EU Renewable Energy Directive target. Some of the existing and planned developments in the study area are already exploiting the renewable energy opportunities and generating renewable energy and contributing towards the national targets.
3.2.3 Building Regulations

The building regulations require all residential houses to be “zero carbon” by 2016 and non-residential developments to achieve this target by 2019. To achieve these challenging targets, improvements in materials, building design and construction techniques will be required, but also the use of renewable or low carbon energy technologies. Complying with these regulations requires the new building stock of the study area to use less energy and of a lower carbon intensity which could be delivered through a district heating network.

3.3 Regional Context

The following regional core strategies have been reviewed to provide a background on the regional low carbon energy initiatives that will influence any development within the Avonmouth / Severnside study area:

- South Gloucestershire Core Strategy with proposed changes. Published in December 2010.
- Bristol Core Strategy with proposed changes. Published in December 2010.

3.3.1 Bristol Development Framework Core Strategy Policy BCS4: Avonmouth and Bristol Port.

This policy identifies the Avonmouth area as a priority area for industrial and warehousing development and renewal and highlights that the Bristol Citywide Sustainable Energy Study has identified significant potential for renewable and low carbon energy installations, e.g. wind, biomass and waste to energy, in the area. It also states that Avonmouth’s economic strengths and low carbon energy opportunities will be supported whilst protecting its environmental assets and acknowledging its development constraints. This support will be provided in collaboration with neighbouring unitary authorities and other relevant stakeholders.

3.3.2 Bristol Development Framework Core Strategy Policy BCS11: Infrastructure and Developer Contributions

This policy identifies two potential mechanisms for developers to contribute to the developments of an area, the use of planning obligations or a Community Infrastructure Levy, to fund the development and provision of infrastructure, services and facilities needed that will support the growth in the city, maintain and improve quality of life and respond to the needs of the local economy. If this policy was applied in the study area, developers could contribute to fund the district heating network.

3.3.3 Bristol Development Framework Core Strategy Policy BCS13: Climate change

This policy sets out a requirement for developments in Bristol to take into account the impact of climate change. Proposed developments should demonstrate through “sustainability statements” how they will contribute to both mitigating climate change and meet targets to reduce carbon dioxide emissions as well as showing how they will adapt to climate change. The district heating network could be used in the sustainability statements for all developments in the Bristol part of the study area as a mitigation climate change feature.
3.3.4 Bristol Development Framework Core Strategy Policy BCS14: Sustainable energy

This policy sets out a requirement for developments to minimise their energy requirements and incorporate renewable or low carbon energy supplies to reduce their carbon dioxide emissions. It also requires developments to provide sufficient renewable energy generation to reduce carbon dioxide emissions from residual energy use in the buildings by at least 20% and that the use of CHP and district heating will be encouraged.

The policy encourages the use of combined heat and power (CHP), combined cooling, heat and power (CCHP) and district heating, and sets up a heat hierarchy that favours the installation of CHP/CCHP distribution networks. These principles will apply particularly to developments within “Heat Priority Areas” that are identified in the Bristol Citywide Sustainable Energy Study. Although Avonmouth is not within one of these areas, the study identifies it as a potential location for the development of low carbon and renewable technologies.

3.3.5 South Gloucester Core Strategy Policy CS3. Renewable and low carbon energy generation.

Similarly to Bristol Development Framework Core Strategy Policy BCS4, this policy states that proposals for the generation of energy from renewable or low carbon sources will be supported in South Gloucester, provided that the installation would not cause significant demonstrable harm to residential amenity, individually or cumulatively.

3.3.6 South Gloucester Core Strategy Policy CS4. Renewable or low carbon district heat networks.

According to this policy, any applications to develop a thermal generating station or proposals that have a capacity to generate significant waste heat as part of an industrial or commercial process must include heat recovery and re-use technology as well as heat distribution infrastructure, or demonstrate that this is not feasible. It also requires that all major development proposals must explore the possibilities of heat distribution on-site, connect to an existing or proposed district heating network or demonstrate that these requirements are unfeasible. This policy in combination with the previous CS3 policy provide some legislative support for a district heating network in the study area.

3.3.7 South Gloucester Core Strategy Policy CS35 – Severnside.

This policy requires all developments in the area to work co-operatively to unlock economic potential of this strategically important location for employment use. It also requires delivering, reconciling and mitigating the development with the site constraints, including flood risk, coastal protection, biodiversity, archaeology and transportation.

In addition, the following regional reports have also been considered in the following sections of this energy study:

In conclusion, a district heating network in the area could contribute towards some of the national and international low energy carbon targets and help the developments in the area meet their building regulations requirements in the future. Finally, regional policies and reports support the idea of low carbon energy generation and district heating networks as long as they are feasible within the environmental, economic and social site constraints.
4 Low carbon energy opportunities in the study area

The “Bristol Energy Master-plan” and the “Potential for Renewable and Low Carbon Energy Supply in South Gloucestershire” reports analyse the availability of renewable and low carbon energy generation resources in the respective Council areas.

The reports conclude that with the exception of wind, solar technologies (photovoltaic and solar hot water) and energy from both wet and solid waste, no other renewable or low carbon technologies could make a significant energy contribution to the study site. In particular, the Bristol Sustainable Energy Study identifies a theoretical maximum CO\textsubscript{2} emission reduction of 22% of Bristol’s total CO\textsubscript{2} emissions in 2006/7 if all available resources were fully exploited. However, it highlights that 17.8% of this reduction would be achieved by energy from waste combined heat and power (CHP) plants whilst local sustainable electricity and heat resources excluding waste would only account for 3.8% and 0.9% respectively. Additionally, if non-local biomass resources were used in a biomass CHP plant, further CO\textsubscript{2} emission reductions of 26% could be achieved. Therefore, energy recovery facilities using municipal sold waste or non-local biomass offer the largest low carbon energy opportunity for the study area.

Nonetheless, generating renewable or low carbon energy in biomass or energy from waste plants, will not bring by itself many benefits to the study area unless that energy is used locally. Electricity generated in these facilities could be used elsewhere because it can be transported through the national electricity grid and therefore has environmental benefits at a national level. However, transporting heat long distances is more complicated than transporting electricity because it requires the construction of significant and costly new infrastructure that will be subject to larger distribution losses so it has to be distributed locally.

Nonetheless, generating renewable or low carbon energy in biomass or energy from waste plants, will not bring by itself many benefits to the study area unless used locally. Electricity generated in these facilities, could be used elsewhere because it can be transported through the national electricity grid and therefore has environmental benefits at a national level. However, transporting heat long distances is more complicated than electricity so it has to be distributed locally through a distribution network.

In conclusion, a local heat distribution network powered mostly with biomass and energy from waste CHP plants offers the best renewable energy opportunity for the Avonmouth/Severnside area because it will maximise the environmental benefits of the low carbon/renewable energy generated in the area.

Table 4—1 below presents a summary of the Bristol Energy Master-plan (The Bristol Study) and the Low Carbon Energy Supply in South Gloucestershire (The South Gloucester Study) assessment of the potential for each different low energy carbon technology in each region. The third column presents a quick technical and economical assessment of each technology potential in the study area using specific information from references in the reports to the Avonmouth/Severnside study area.
<table>
<thead>
<tr>
<th>Technology</th>
<th>Assessment summary in Bristol Study</th>
<th>Assessment summary in South Gloucester Study</th>
<th>Assessment for Avonmouth/Severnside area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydropower</td>
<td>No potential found.</td>
<td>Technology not considered in the report.</td>
<td>No potential has been found for this technology in river Avon.</td>
</tr>
<tr>
<td>Biogas</td>
<td>There is an anaerobic digestion plant in the Wessex Water waste water treatment plant that generates energy from biogas.</td>
<td>Technology not considered in the report.</td>
<td>The existing anaerobic digestion plant in the Wessex Water waste water treatment plant is located within the study area (see Figure 5—3) and no further potential has been identified.</td>
</tr>
<tr>
<td>Wind</td>
<td>The Avonmouth area represents the vast majority of Bristol's potential for wind power, however, the installation of large scale wind turbines is highly constrained by the presence of environmental protected areas and, until it closes, Filton Airfield. Sites identified as suitable for large scale wind are already exploited or the council has already received planning applications to install wind turbines on them. Small scale wind has more installation potential although much lower renewable energy generation.</td>
<td>The study identifies some large scale wind potential locations in the region, although it highlights the largest potential is in the nearby Avonmouth area that is part of Bristol City Council’s area. Very limited potential renewable electricity generation from building-integrated small scale wind technologies.</td>
<td>Large scale wind turbines are already installed or proposed in the sites with the largest wind potential in the study area so once the proposed turbines are built this resource will be fully exploited in the area. Small scale wind turbines could be installed in existing and new developments within the area. However, the amount of renewable electricity generated will be limited and their economic feasibility compromised because of low wind speeds. Therefore, small scale wind turbines are not further considered in this study although they could be considered for individual developments within the study area.</td>
</tr>
<tr>
<td>Technology</td>
<td>Assessment summary in Bristol Study</td>
<td>Assessment summary in South Gloucester Study</td>
<td>Assessment for Avonmouth/Severnside area</td>
</tr>
<tr>
<td>------------------</td>
<td>----------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------</td>
<td>-----------------------------------------</td>
</tr>
<tr>
<td>Solar technologies</td>
<td>There is potential for installing photovoltaic (PV) and solar hot water (SHW) panels in roofs of existing and new developments. The overall contribution of these technologies to reduce CO₂ emissions from the site will be limited. These technologies could benefit from the Feed In Tariffs (FIT) and the Renewable Heat Incentive (RHI).</td>
<td>Same analysis as for Bristol.</td>
<td>Both PV and SHW panels could be installed in the roofs of existing and new developments within the study area. B2/B8 uses have typically large un-shaded roof areas that are very suitable for installing these panels. The high costs of PV panels make them only suitable to be installed in individual buildings whilst SHW panels are not suitable for B2/B8 building uses because of the low SHW demand in them. The high costs of a large PV installation across multiple developments in the study area and the technical complexity of integrating SHW panels into a district heating network mean that solar technologies should only be considered for individual developments within the study area rather than at a site-wide scale.</td>
</tr>
</tbody>
</table>
### Heat pumps

The study concludes that unless the RHI offers significant incentives for heat pumps, it is unlikely that they will be widely installed. Heat pumps are considered to be suitable as building integrated technologies rather than for large installations. It is not forecasted that heat pumps will have a large uptake. The use of heat pumps in the study area is deemed as possible, although limited to new developments within the study area with substantial space heating/hot water demands.

### Biomass

There is a limited biomass supply when considering Bristol City only. Considering larger catchment areas and including waste, woodland and arboriculture activities the amount of available resource improves. The study has the same conclusions as the Bristol study. Limited local biomass resources and supply. Mostly coming from waste wood that would have to be processed in facilities compliant with the waste incineration directive limit. There is a proposed biomass chipper facility in Avonmouth docks which may help establish a biomass supply chain to the area. If non-local biomass resource was used, biomass CHP plants could generate renewable power and particularly heat that could be distributed within the study area through a district heating network.
### Technology

<table>
<thead>
<tr>
<th>Energy crops</th>
<th>Assessment summary in Bristol Study</th>
<th>Assessment summary in South Gloucester Study</th>
<th>Assessment for Avonmouth/Severnside area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very limited space available for energy crops plantation in Bristol City although miscanthus could be grown in nearby agricultural land. Potential conflict with other uses.</td>
<td>The study has the same conclusions as the Bristol study.</td>
<td>Energy crops could be planted on Bristol City Council Tenant Farms and burnt in biomass boilers. This technology can generate some renewable heat but its contribution will be very limited due to the availability of the resource.</td>
<td></td>
</tr>
</tbody>
</table>

| Solid waste | Energy could be recovered from large quantities of residual, i.e. non-recyclable, solid waste as described in the Joint Waste Core Strategy. There is only a small pyrolysis plant treating residual waste in Avonmouth. | The study has the same conclusions as the Bristol study. | There are approved and proposed large scale energy from waste plants (see section 6.2) capable of treating residual solid waste in the study area. These plants typically generate power but could also potentially generate heat, which would be partially renewable, and could be distributed locally via a district heating network. |

| Wet waste | Large quantities of food and sewage sludge are generated in Bristol City which could be treated in anaerobic digesters. There is an anaerobic digestion plant treating wet waste in the Wessex Water waste water treatment plant. | Technology not considered separately from solid waste in the report. | The existing Wessex Water waste water treatment plant is within the study area and has a sewage sludge anaerobic digestion CHP plant and therefore this resource is fully exploited. |

<table>
<thead>
<tr>
<th>Technology</th>
<th>Assessment summary in Bristol Study</th>
<th>Assessment summary in South Gloucester Study</th>
<th>Assessment for Avonmouth/Severnside area</th>
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</table>

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**Table 4—1 Renewable energy technologies potential in Bristol City and Avonmouth/Severnside study area**
5 Unlocking the potential

The previous section has identified that a district heating network powered mostly with biomass and energy from waste CHP plants offers the best renewable energy opportunity for the Avonmouth/Severnside area because it will maximise the environmental benefits of the low carbon/renewable energy generated in the area and could act as a catalyst to unlock the area potential. Following from it, this section describes the drivers and barriers for the implementation of such a network as well as describing the existing situation in terms of heat sources and heat demand of the current and “business as usual” building use mix.

5.1 Drivers

Several important drivers supporting a district heating network in the area have already been identified in previous sections, e.g. international, national and regional legislative drivers identified in section 3, and the fact that a district heating network represents the best renewable energy opportunity for the Avonmouth / Severnside area as summarised from the “Bristol Energy Master-plan” and the “Potential for Renewable and Low Carbon Energy Supply in South Gloucestershire” reports in section 4.

Another two very important drivers for district heating networks are the economic and environmental benefits - reduced operational costs and CO₂ emissions. These benefits could be further increased in the study area if some of the heat were generated from renewable biomass and waste sources in local plants (see section 6.2).

In addition, district heating networks also bring the following benefits to generators, users and the local area as a whole:

- Developing local economies;
- Fuel flexibility;
- Improving security of energy supply;
- Reduction of plant space requirements and capital cost; and
- Ease of maintenance.

The possibility of connecting to a district heating network capable of distributing the large amounts of heat locally generated heat from biomass or waste treatment CHP plants could act as a catalyst to shift away from the “business as usual” development mix of B2/B8 uses in the study area. However, a separate detailed market analysis will be required to assess the number and type of companies that could be attracted to the area specifically because of the presence of a district heating network. Some of these companies may include environmental technology, advanced waste processing, cleaner production, resource efficiency and associated advanced engineering technologies companies as well as companies with large heat demands covered by the
Carbon Reduction Commitment (CRC) Energy Efficiency Scheme. Section 8.2 discusses the type of companies that could be attracted to the area in more detail.

Finally, the possibility of a district heating network in the area becoming the seed for a city-wide district heating network that could extend over time towards the Heat Priority Areas identified within the Bristol Citywide Sustainable Energy Study (see Figure 5—1) is an attractive opportunity. However, the long distances between the study area and the heat priority areas and the need to lay connecting pipes across the city centre represent significant technical and economic barriers that would have to be assessed in detail in further studies.

Figure 5—1 Heat priority areas in Bristol (Source: Bristol Citywide Sustainable Energy Study)

5.2 Barriers

The economic and technical risks associated with the funding, design, build and operation of a district heating network, as well as the management issues associated with its ownership and the stakeholder management are the most important barriers to the deployment of a district heating network in the study area.

Firstly, the capital cost of district heating networks is a very important barrier for its deployment. For a district heating system to be viable the cost of establishing the network has to be recovered from the income of selling
energy to the customers, whilst being economically attractive for customers to sign up. The latter statement has an intrinsic risk because customers have the freedom to change energy suppliers. This might prevent recovering the capital investment and negate the environmental benefits associated with the operation of the network. Therefore, maximising customer participation and retention, is paramount for the economic feasibility of the network.

Another potential barrier for the network is the very low heat demand existing in the area because of the existing B2/B8 building stock (see Figure 5—2 and Figure 5—3). Although the presence of the district heating network could act as a catalyst for changes to the building stock, the extent of any such changes is difficult to predict over time and further studies will be required to assess if the heat sales to the current and possible future buildings in the area would be enough to recover the capital investment on infrastructure.

Technically, the physical construction of the district energy infrastructure in the Avonmouth/Severnside area will be complex in terms of distance and layout. The network will have to cross other infrastructure elements (see Figure 6—1), such as railway lines and motorways that cross and surround the area and which will present some technical challenges and increase the cost.

Finally, management issues related to the network ownership as well as the stakeholder, both public and private, and customer management are another important barrier for district heating. Some of these issues can be addressed by involving an Energy Services Company (ESCO) that can help with the financial, technical and management aspects of the network.

5.3 Existing situation

Some of the developments in the area already incorporate some efficient energy generation measures, for example the Wessex Water waste water treatment plant CHP, whereas others either have or have applied for permission to install renewable generation technologies, e.g. the wind turbines proposed by the Bristol Port Company, Wessex Water and the Bristol City Council.

Existing developments in the area, mostly comprising B2 and B8 uses, have low heat demand. This can be seen in Figure 5—2 extracted from DECC’s heat database. These maps, although without very high resolution, show that heat demand in the Avonmouth / Severnside area is almost entirely due to small scale industry.
Figure 5—2 Heat Demand in the Bristol area from DECC UK Heatmap.

More detailed versions of these heat maps have been prepared by The Centre for Sustainable Energy and Geofutures Ltd. Figure 5—3 shows more detailed views of the total heat demand in the study area as well as the areas where the heat demands are less variable, e.g. anchor loads (see section 7.4), that have the highest potential for district heating. These maps show that the constant heat demand in the Avonmouth/Severnside area, which is best suited to a district heating network, is concentrated in the residential zone outside the South boundary of the study area whilst within the study area, constant heat demand is quite low because the existing B2 and B8 buildings uses have low heating requirements.

In addition, two existing heat sources are shown in Figure 5—3 by a green circle and a purple triangle, the Seabank power station and the Wessex Water waste water treatment plant CHP plant. Due to a limited representation capacity of the maps, these plants are slightly misplaced in them as they are both to the North of the M49 hence within the Avonmouth/Severnside study area.
Further study will be required to identify if the Seabank power station design allows exporting heat or if it would require major modifications to be considered as a heat source for a potential district heating network. Similarly, additional research will be needed to find out if the CHP plant installed in Wessex Water waste water treatment plant is sized only for exporting heat within the sewage works site or if it has spare capacity and could be connected to a local district heating network.

Figure 5—3 Detailed heat demand in the Avonmouth area from South West Heatmap.
5.4 Future development

The previous section showed how the existing situation in the study area is not ideal for installing a local district heating network. This section explores how this situation might change as a result of changes in the heat sources and the development mix.

5.4.1 Heat sources

Some of the proposed energy generation developments in the area, e.g. Helius energy or Cyclamax facilities (see section 6.2 for further details), intend to use low carbon energy sources, e.g. biomass or waste, and could be fitted with high efficient energy generation technologies, e.g. CHP. They could be connected to a district heating network that would allow the surplus heat to be used locally.

5.4.2 Business as usual development mix

Table 5—1 presents a summary of the past developed areas as well as those proposed to be developed (see Appendix for reference). It shows how in a “business as usual” scenario most future developments in the study area will be similar to the existing mix of B2/B8 uses. If this is the case, although the total heat demand in the area will increase, the energy demand density, a key parameter to assess the feasibility of a district heating network (see section □) will remain low. Furthermore, as a result of the introduction of more stringent building regulations in the future that require new buildings, including those replacing the existing ageing building stock, to have lower CO₂ emissions and therefore lower energy demands, it is likely that the energy demand density may even be lower in the future.

<table>
<thead>
<tr>
<th>Building type</th>
<th>Past development over last 10 years on greenfield and previously developed land</th>
<th>Future development on undeveloped land within the area of the 57/58 Permission</th>
<th>Future development on greenfield land under private ownership</th>
<th>Future development on greenfield land under council ownership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total plot area (m²)</td>
<td>1,598,000</td>
<td>2,447,000</td>
<td>356,000</td>
<td>499,000</td>
</tr>
<tr>
<td>Total gross area (m²)</td>
<td>599,250</td>
<td>727,982</td>
<td>75,990</td>
<td>127,245</td>
</tr>
<tr>
<td>Industrial (B2)</td>
<td>20%</td>
<td>0%</td>
<td>60%</td>
<td>70%</td>
</tr>
<tr>
<td>Warehouse (B8)</td>
<td>80%</td>
<td>95%</td>
<td>30%</td>
<td>20%</td>
</tr>
<tr>
<td>Sui Generis</td>
<td>0%</td>
<td>5%</td>
<td>10%</td>
<td>10%</td>
</tr>
</tbody>
</table>

Table 5—1 Past and future development area and development mix
Figure 5—4 presents the modelled future heat demand in Bristol according to the Bristol Energy Masterplan and South West heat map that shows that only a few locations in the study area will have a significant, although low, heat demand.

Colour key: High heat demand Low heat demand

Figure 5—4 Modelled future heat demand in Bristol (Source: Bristol Energy Masterplan and South West heat map.)

5.5 Conclusions

Previous sections have shown that there are some very powerful drivers, but also some significant barriers, for the implementation of a district heating network in the study area and that it represents the best renewable energy opportunity for the Avonmouth / Severnside area. Therefore, this network presents an opportunity to unlock the area potential and the following sections describe how this network may look like and present an initial feasibility study for it. However, such a network will only be feasible if the future mix of development in the area were to include users with a high heat demand. At present, there are few such users within the study area.
6 District heating network

This section briefly describes a district heating network as well as the heat sources available in the area and a possible network layout.

6.1 Description

District heating networks supply heat to a number of buildings or dwellings from one or multiple centralised energy production facility/facilities by means of a grid and a pipe network carrying hot water or steam.

The network consists typically of two pipes, one flow and one return, the former with a higher temperature of 90 °C or even 120 °C whilst the return will have a temperature of between 40 °C or 70 °C. These pipes are typically made of steel or a rigid plastic and factory assembled with pre-insulation. They are connected to heat exchangers typically located within each building and that separate the district heating pipe circuit and the internal building circuits. The heating systems within each building do not need to be different from traditional systems, e.g. radiators, and the only difference will be in the energy meter that will meter heat as opposed to gas or electricity.

Developing district heating systems requires substantial initial investment in infrastructure, including pipe networks to connect existing and future buildings and the construction, or connection, of a central energy centre or series of them. However, this infrastructure provides an opportunity for the use of large scale CHP and renewable energy technologies that can achieve substantial carbon savings when compared to use of conventional gas supply. District systems can also achieve other benefits including, long term fuel flexibility, lower energy prices and a reliable income stream.

6.2 Heat sources

Some of the existing and proposed energy and waste plants in the study area are potential heat sources for a district heating network. Their location are shown in Figure 6—1 and Table 6—1 summarises the potential amount of heat that these plants could generate.

<table>
<thead>
<tr>
<th>Plant name</th>
<th>Situation</th>
<th>Thermal output (MWth)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helius energy</td>
<td>Pending approval</td>
<td>200</td>
<td>Estimated a heat to power ratio of 2:1 (same as used in Bristol Energy Masterplan) to the intended electricity generation of 100 MWe.</td>
</tr>
<tr>
<td>Plant name</td>
<td>Situation</td>
<td>Thermal output (MW&lt;sub&gt;th&lt;/sub&gt;)</td>
<td>Comments</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------</td>
<td>----------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Cyclamax</td>
<td>Approved</td>
<td>25</td>
<td>Estimated a ratio of 2:1 (same as used in Bristol Energy Masterplan) to the planned electricity generation of 12.5 MW&lt;sub&gt;e&lt;/sub&gt; &lt;sup&gt;1&lt;/sup&gt;.</td>
</tr>
<tr>
<td>New Earth Solutions</td>
<td>Approved</td>
<td>7.5</td>
<td>A capacity of 7.5 MW&lt;sub&gt;e&lt;/sub&gt; is quoted in the company page &lt;sup&gt;2&lt;/sup&gt;. A heat to power ratio of 1:1 is used instead of 2:1 as it is expected that some of the heat generated will be used in the nearby MBT plant.</td>
</tr>
<tr>
<td>Sita</td>
<td>Denied</td>
<td>74</td>
<td>Estimated a heat to power ratio of 2:1 (same as used in Bristol Energy Masterplan) to the intended electricity generation of 37 MW&lt;sub&gt;e&lt;/sub&gt;.</td>
</tr>
<tr>
<td>Viridor</td>
<td>Approved</td>
<td>60</td>
<td>Estimated a heat to power ratio of 2:1 (same as used in Bristol Energy Masterplan) to the intended electricity generation of 30 MW&lt;sub&gt;e&lt;/sub&gt;.</td>
</tr>
<tr>
<td>Ethos Group</td>
<td>Approved but progress unclear</td>
<td>15.2</td>
<td>Assuming the plant will have two MT8 units each with a capacity of 32,000 tpa (similar to the consented capacity of 70,000 tpa) with a total electric output of 7.6 MW&lt;sub&gt;e&lt;/sub&gt; &lt;sup&gt;3&lt;/sup&gt; and a heat to power ratio of 2:1 (same as used in Bristol Energy Masterplan).</td>
</tr>
</tbody>
</table>

Table 6—1 Potential thermal output of proposed energy recovery facilities in study area

6.3 Proposed network layout

Figure 6—1 shows the proposed network layout which could be built initially around the Cyclamax and New Earth Solutions energy recovery facilities (identified as heat sources 1 and 2 respectively) and that have

<sup>1</sup> http://www.avonmouthresourcepark.co.uk/images/pdfs/AvonmouthNTS.pdf

<sup>2</sup> http://www.newearthsolutions.co.uk/our-facilities-and-projects/

planning permission but are not yet built. The figure also shows an existing chilled distribution centre and the in-vessel composting plan proposed by SITA and that are identified as anchor loads 1, 2.

Figure 6—1 Proposed district heating network routing and location of heat sources and anchor loads
6.4 Phasing

The location of some heat sources in close proximity to some potential anchor loads in the South part of the study area which is bounded by the railway line and the M49 and M5 suggests that the district heating network could be initially installed in that area and later expanded to the North of the site crossing the railway line parallel to the bridge over Smoke Lane.

The North part of the network should follow any new spine/distributor road to minimise costs, but also considering the location of potential heat sources and demand. The extension to the North beyond the M49 will require the network to cross major infrastructure again and it is proposed that this could be done following the Holloway Road bridge. The proposed route connects most of the proposed development sites to the network to maximise revenue options.

The length of the first stage of the district heating network is about 1.0 km with the remaining pipe length measuring 9.0 km. This excludes individual connections to each development/user. Approximately 4.0 km of the 10.0 km of pipes of the network could be laid out at the same time as the new spine road achieving some capital savings (see section 7.5). Figure 6—1 also shows other connections to potential heat sources which would require a pipe distance of 1.0 km.

As mentioned in section 5.1, the presence of very important heat sources, either existing or planned, within the study area combined with the proposed district heating network represent an opportunity for an embryonic Bristol wide district heating network that could extend South towards the Heat Priority Areas identified in the Bristol Citywide Sustainable Energy Study (see Figure 5—1). Such a district heating network will enable the distribution of decentralised heat generation and contribute significantly to the renewable energy targets for Bristol and South Gloucestershire County Councils although not without significant technical and economic challenges.
7 Feasibility

This section explores the following aspects that influence the economic feasibility of the proposed district heating network, and therefore its ability to provide environmental benefits:

- Existing and future heat demand density;
- Heat demand profile;
- Anchor heat loads; and
- Heat sources (already described before in section 6.2)

7.1 Assumptions

The following assumptions are used throughout this feasibility assessment:

- An Energy Services Company (ESCO) will be set up to design, build, operate, maintain and managed the district heating network, liaise with the heat generators and bill the end users.
- The ESCO will buy heat from the generators at wholesale prices and will sell it at retail prices to individual developments within the study area with all the profit obtained used to repay the capital cost of the network.
- Only the current approved heat sources have been considered i.e. Cyclamax, New Earth and Viridor.
- The heat output from these facilities has been estimated with a 2:1 heat to power ratio (see section 6.2) that has already been used in the Bristol Energy Masterplan.
- The calculations have been made assuming full occupancy and developments completed on undeveloped sites broadly in accordance with the Figure 6—1 above.
- Only 50% of existing B2/B8 developments have space heating (this approximately matches the information shown in the available heat maps).
- 100% of all new B2/B8 developments will have space heating in future developments due to heat availability.
- Demand from Sui Generis developments has not been considered.
- No process load has been considered.
- The cost of installing the district heating pipes has been based on estimates from past Buro Happold projects.
• Energy prices and incentives will remain fixed over time due to the large uncertainty on these.
• No operational or maintenance costs have been assumed (pending a detailed study for the district heating network).

As a result of these assumptions, the current outline feasibility assessment presents a best case scenario for the feasibility of the district heating network and the findings presented here will have to be refined and validated with additional information and sensitivity analyses.

7.2 Existing and future heat demand density

Heat demand density is typically used as a starting point for assessing the viability of district heating networks. The lower the heat demand density, the higher the infrastructure capital cost compared to potential revenues. In addition, pipe heat losses make up a greater proportion of the total heat supply, which affects both the financial viability and environmental benefits.

There are two main ways of representing heat demand density:
• Area heat demand density, which is expressed in kWh/m$^2$/year as an energy demand over land area. Note it is not built area, but the total land area of development.
• Line heat demand, which is expressed as an energy demand per unit length of pipe (kWh/m/year)

The report ‘The Potential and Costs of District Heating Networks’ published by Poyry and Faber Maunsell in 2009 for DECC investigated the viability of district heating to serve the existing UK building stock and identified a minimum area heat density of 26 kWh/m$^2$/year as the threshold for district heating viability. Another source, the International Energy Agency report ‘District Heating Distribution in Areas of Low Heat Demand Density’ published by IEA in 2008, estimates that district heating systems can be viable at heat densities as low as 10 kWh/m$^2$/year or line heat demands of 300 kWh/m/year if advanced design measures are employed and recognises line heat demand as a more accurate measurement of viability as it takes account of the heat network layout. However, because only an indicative layout of the network is available and no detailed location and heat demand information is available, the area heat demand density will be used in this assessment.

Table 7—1 summarises the information on average CO$_2$ emission rates, energy demand and the calculation assumptions used to estimate current and future space heating demands from the current and proposed developments in the study area. Hot water demand for B2/B8 uses is likely to be negligible. Table 7—2 shows the estimated heating demand density using the areas shown in the Appendix.
<table>
<thead>
<tr>
<th>Building type</th>
<th>CO₂ emissions from heating and hot water</th>
<th>Thermal energy demand</th>
<th>Comments / Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit</td>
<td>kg CO₂/m²/year</td>
<td>kWh/m²/year</td>
<td></td>
</tr>
<tr>
<td>Industrial (B2)</td>
<td>1 + 0</td>
<td>4.9</td>
<td>May have a high heat process demand. All space is conditioned in current and future developments</td>
</tr>
<tr>
<td>Warehouse (B8)</td>
<td>17 + 0</td>
<td>83.3</td>
<td>Estimated that only 50% of existing warehouses have space heating to roughly match information shown in heat maps. Assumed that 100% of warehouses will have space heating in future developments due to heat availability.</td>
</tr>
<tr>
<td>Offices (B1)</td>
<td>20 + 3</td>
<td>112.7</td>
<td>Will not have any process heat demand. Possible future building use.</td>
</tr>
<tr>
<td>Sui Generis</td>
<td>Not available</td>
<td>Not available</td>
<td>May have a high heat process demand.</td>
</tr>
</tbody>
</table>

Table 7—1 Heating CO₂ emissions, energy demand and assumptions

<table>
<thead>
<tr>
<th>Type of development</th>
<th>Past development over last 10 years on greenfield and previously developed land</th>
<th>Future development on land with 57/58 permission</th>
<th>Future development on other greenfield land</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated heat demand density (kWh/m²/year)</td>
<td>12.8</td>
<td>33.7</td>
<td>5.5</td>
</tr>
</tbody>
</table>

Table 7—2 Estimated heating demand density

4 Table 6 in the consultation document on “Definition of zero carbon homes and non-domestic buildings” published in December 2008 by HMRC

5 Carbon factor of 0.204 kgCO₂/kWh of natural gas, assumed to be the traditional heating method, as published in August 2010 by DEFRA in table 1 of the guidance to report GHG emissions.
As a result of the assumption that all future warehouses will have space heating due to the availability of heat, developments, the development proposed in the residual land of the area with 57/58 permission present the best opportunity for the development of district heating. However, installing a district heating network to supply heat to the proposed developments in the remaining residual land within the study area but outside the 57/58 permission area is not viable as they have a heat energy demand density below the threshold identified by Poyry and Faber Maunsell of 26 kWh/m$^2$/year. Finally, the existing developments within the study area have an estimated heat demand density below the Poyry and Faber Maunsell threshold but still above the lower threshold of 10 kWh/m$^2$/year identified by IEA for which district heating networks could be feasible if advanced design measures were employed.

However, this assessment only takes into account space heating demands but no process demands or requirements for specific developments, e.g. composting process, chilled storage, work environments with closely controlled temperature requirements, nor the potential impact that other building uses that may be attracted to the area may have. If these were considered, heat demand density in the area may increase and could make the development of a district heat network viable on land outside the area of the 57/58 permission.

In summary, installing a district heating network to serve new developments in the area covered by the 57/58 planning permission will be economically feasible and it can help with the feasibility of installing a network supplying existing developments within the study area, which otherwise will be borderline. Nonetheless, because the above assessment has not considered the possibility of serving specific process loads or developments demands, a detailed market research will be necessary to refine these results. Moreover, further research will also be necessary to assess how exactly the building use mix might change as a result of the presence of the district heating network that and how this in turn might increase the feasibility of the network creating a positive feedback loop that will unlock the area potential.

### 7.3 Heat demand profile

The heat demand profile is a very important design factor for a district heating network. If the network is sized to supply the peak load and there is a large difference between it and the baseline load, the network will be more expensive to build and operate and its capacity will be under-utilised most of the time. Moreover, networks that supply constant heat demands require less investment for the same environmental benefits.

B2/B8 uses have daily variable heat demands as shown in Figure 7—1. In addition, they also have seasonal heat demands, e.g. higher in winter and lower in summer.
This variability is not ideal for the operation of district heating network although it could be accommodated if there was enough of a baseline provided by “anchor loads” that would help to smooth the relative effect of the peaks. The detailed effect of this demand variation should be further study in a detailed feasibility assessment.

### 7.4 Anchor loads

Large heat users with relatively constant heat demands could act as “anchor loads” that may increase the feasibility of district heating networks. These anchor loads bring the following benefits to the heating network:

- **Economic.** Anchor loads are a source of secure income thus improving the economic feasibility of the network and attracting potential energy services companies.
- **Technical.** Anchor loads are typically constant thus providing the base load for the district heating and smoothing heat demand profiles;
- **Environmental.** Anchor loads can act as catalysts for the creation of a district heating network that could deliver low carbon heat to other nearby developments that would otherwise had used fossil fuels for heating.

Not only large heat loads, but also large cooling loads could also be considered anchor loads because absorption cooling chillers can use heat to provide cooling.

Within the study area, there are some existing anchor loads. These include an in-vessel composting facility and a chilled storage centre (see Figure 6—1). Other potential anchor loads include a proposed biomass to biodiesel plant and a biomass chipping facility, both in the Avonmouth docks. Other anchor loads such as those discussed in 8.2 could be attracted if a district heating network was set up in the area.

### 7.5 Capital costs

District heating network infrastructure is expensive, particularly if laid in an already developed area. Based on estimations and past project experience, on average savings of around 17% of the capital costs will be achieved.
because it will not be necessary to dig trenches and reinstate the surface to its previous condition if the installation is coordinated with other infrastructure work. Therefore, to maximise the return of investment and environmental benefits, it has to be done initially in areas with current or expected high and constant heat demands. Once the initial investment is made, the marginal cost of expanding the network to supply other loads will be less than installing it for the first time.

These capital costs estimations are based on a network capable of distributing the heat produced in the heat plants already approved and the layout described in Figure 6—1 and will need refinement in future detailed studies.

In a first approximation, it has been estimated that a district heating pipe with a diameter of 600 mm would be enough to carry around 100 MW of heat. This is equivalent to the heat output from the heat plants that have planning permission and could even accommodate heat from the Ethos facility should it become on-line.

In addition to the main district heating network, additional connections will be required to each individual development. Given the initial stages of the design, an additional 100% of 25 mm piping has been deemed necessary for this connection. Nonetheless, this assessment is based on past experience for residential projects which may not be fully applicable for the B2/B8 use mix.

These assumptions together with the distances shown in Figure 6—1 have been summarised in Table 7—3. The total cost for the network has been estimated at £30m.

<table>
<thead>
<tr>
<th>Pipe diameter</th>
<th>New development pipe costs (£m/km)</th>
<th>Existing development pipe costs (£m/km)</th>
<th>Distance in new development (km)</th>
<th>Distance in existing development (km)</th>
<th>Total cost (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 mm</td>
<td>0.3</td>
<td>0.4</td>
<td>4.0</td>
<td>6.0</td>
<td>3.6</td>
</tr>
<tr>
<td>450 mm</td>
<td>2.4</td>
<td>2.9</td>
<td>4.0</td>
<td>6.0</td>
<td>26.4</td>
</tr>
</tbody>
</table>

Table 7—3 Estimated unitary district heating capital costs

7.6 Revenues

Using the same assumptions as for the heat demand density estimations, Table 7—4 shows the estimated heat that will be demanded by the developments in the different parts of the study area. In total, 107.6 GWh of heat will be demanded annually in the study area once fully built.
Type of development | Past development over the last 10 years on greenfield and previously developed land | Future development on undeveloped land within the 57/58 Permission | Future development on other greenfield land
--- | --- | --- | ---
Total gross area (m²) | 599,250 | 727,982 | 203,235
Estimated heat demand (GWh/year) | 20.5 | 82.4 | 4.7

Table 7—4 Estimated heat demand in the study area

The total estimated thermal capacity of the approved plants, i.e. Cyclamax, New Earth and Viridor, is 92.5 MWth as shown in Table 6—1, which if assumed to operate for 8,000 hours a year would generate 740 GWh of heat a year, more than enough to supply all the proposed developments within the study area.

According to Figure 7—2 that shows the price of gas from the quarterly tables published by DECC and last updated 31 March 2011, a price of between 1.8 and 2.8 pence per kWh (p/kWh) can be expected for heat depending on the client heat demand. Nonetheless, the figure also shows that these figures are highly variable with time. As described in section 7.1, it has been assumed that these prices will be constant and that heat will be bought in bulk from producers at 1.8 p/kWh, and sold to retail prices to customers at 2.8 p/kWh, a maximum yearly revenue of just over £1m will be achieved.

| Type of development | Past development over the last 10 years on greenfield and previously developed land | Future development on undeveloped land within the 57/58 Permission | Future development on other greenfield land
--- | --- | --- | ---
Costs (£m) | 0.369 | 1.483 | 0.085
Revenue (£m) | 0.574 | 2.307 | 0.132
Profit (£m) | 0.205 | 0.824 | 0.047

Table 7—5 Estimated heat costs, revenues and profits
Low Carbon Energy Incentives

Some financial incentives are available for low carbon energy technologies and a district heating scheme using waste heat or a renewable fuel could benefit from some of them. These incentives provide a great support for the UK low carbon energy industry, making renewable energy far more cost-effective for all developments.

- **Renewable Heat Incentive (RHI).** Recently, through the UK Renewable Energy Strategy published by DECC in 2009, the UK Government has announced a RHI that will provide generators with additional income from the production of renewable heat. DECC intends to implement the RHI by June 2011. Renewable heat distributed through a district heating network will qualify for this incentive thus increasing the economic feasibility of the scheme. The current proposal is for large scale biomass facilities, as those existing or proposed in the study area, will receive a tariff of 2.6 p/kWh although only the renewable fraction of the heat will qualify for it. The current proposal sets out that unless a higher percentage of biomass content is proven, a default of 50% will be used.

- **Climate Change Levy (CCL).** Exemption A CHP scheme, either new or upgraded, can be exempt from the CCL, if it proves to be “Good Quality CHP” as defined by the CHP Association. Existing and proposed power plants in the study area could be either built as CHP facilities or retrofitted to allow them to export...
heat thus qualifying for this incentive and improving their economic feasibility. From 1 April 2012, the CCL will be 0.177 p/kWh.

- Renewable Obligation Certificates (ROC) and Feed In Tariff (FIT). Renewable Obligation Certificates are awarded to large scale renewable energy generators proportionally to the amount of renewable energy and the technology they use. These certificates can then be sold to electricity distribution companies for a premium. For small scale installations, the Feed In Tariff system applies and small scale generators can benefit from a fixed price on the electricity they generate. Large renewable electricity generators already exist in the area, e.g. wing turbines, whilst smaller installations could potentially be installed in individual developments if deemed appropriate. This incentive will not be applicable to a district heating network.

In summary, assuming that all the CCL and only 50% of the RHI could be claimed by the currently approved facilities that will use waste as feedstock, the total incentive per kWh generated will total 1.47p/kWh.

### 7.8 Economic summary

Table 7—6 summarises the economic model assumptions as well as the capital costs, operational costs, revenues and incentives of the proposed district heating network.

<table>
<thead>
<tr>
<th>Value</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital costs (£m)</td>
<td>30.0</td>
</tr>
<tr>
<td>Annual Energy Costs (£m)</td>
<td>1.9</td>
</tr>
<tr>
<td>Annual Energy sales Revenue (£m)</td>
<td>3.0</td>
</tr>
<tr>
<td>Annual Energy Profit (£m)</td>
<td>1.1</td>
</tr>
<tr>
<td>Annual incentive (£m)</td>
<td>1.6</td>
</tr>
</tbody>
</table>

**Table 7—6 Costs, revenues and incentives for the district heating**

Figure 7—3 shows the NPV evolution over a period of 30 years, and the payback periods, of the district heating network for different discount factors with the numerical representation shown in Table 7—7. The discount rates used are a 3.5% social discount factor described in the Green Book, a more common 6% discount factor that would be typical for a commercial enterprise, and even more aggressive discount factor of 10%. In this last case, the investment is never recovered even in a period of 50 years.
Figure 7—3 NPV of district heating

<table>
<thead>
<tr>
<th>Discount factor</th>
<th>3.5%</th>
<th>6.0%</th>
<th>10.0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payback period (years)</td>
<td>14</td>
<td>19</td>
<td>N/A</td>
</tr>
<tr>
<td>NPV in 30 years (£m)</td>
<td>18.8</td>
<td>6.5</td>
<td>-4.9</td>
</tr>
</tbody>
</table>

Table 7—7 Economic summary of feasibility study.
8  Recommendations

As a conclusion to this energy study, this section presents a set of recommendations grouped into categories for SWDRA, Bristol City Council and South Gloucestershire Council to implement.

8.1  Techno-economic recommendations

It is understood that Low Carbon South West has commissioned work to assess the technical and commercial feasibility of an Avonmouth/Severnside district heat grid which will provide detailed information to SWDRA, Bristol City Council and South Gloucestershire Council on a possible district heating network in the study area.

If the detailed feasibility study recommends building a district heating in the study area, or a part of it, it is suggested to engage an energy services company (ESCO) to share the funding, designing and building the network as well as to operate, maintain and manage its heat generators and consumers in return for some of the economic benefits that will be achieved during its operation. In addition, a phased build out of the district heating network is proposed to minimise upfront capital expenditure and risks. Pending the detailed study results, it is suggested to start the network in the South of the study area and then expand it to the North. The South of the site concentrates some of the heat generators, e.g. New Earth Solutions and Cyclamax plants, as well as some potential anchor loads, e.g. chilled distribution centre and in-vessel composting plant, whilst the Viridor plant just granted planning permission and the 57/58 planning consent area that presents the best opportunity to install a district heating network because of its high heating demand density are in the North. The revenues obtained from the operation of the first phases of the network can help to partially fund its expansion.

In the long-term, the feasibility of connecting the district heating network in the study area to a network serving the Heat Priority Areas identified to the South of Bristol should also be studied.

Finally, it is also recommended to align the network layout with existing infrastructure, e.g. road, railway, etc. and to synchronise the construction of the network with the proposed spine road or other new infrastructure when possible, to minimise costs.

8.2  Development use mix recommendations

The assessment presented in section 7.2 shows that, pending further detailed study, the proposed business as usual development mix would only justify the installation of the network in the residual land with 57/58 permission and that higher heating demand density values will be necessary to justify the installation of the network in other parts of the study area. This means that, from a heat demand point of view, the current and proposed development mix of B2/B8 uses is not optimum and building uses with higher space heating, hot water or process heat demands would be more appropriate.

Therefore, it is suggested to commission a market study to assess the interest of companies with high heating or cooling loads to relocate to the study area to increase the feasibility of the network. The study should explore
the how willing companies will be to relocate as a result of the presence of the district heating network, as well as some of the other proposed improvements to the area such as transport links. The possibility of attracting business with high cooling demands should also be considered because absorption cooling equipment can use heat to generate cooling.

The presence of business with high heating or cooling loads in the area should not be seen as unlikely because some of the existing or already approved developments in the area, include:

- Chilled storage centre;
- In vessel composting facility near the Seabank power station;
- Biomass to biodiesel plant in the Avonmouth docks; and
- Biomass chipping facility in the Avonmouth docks.

Therefore, and given the background of the study area, it should be possible that some of the businesses in the key sectors identified by the client, e.g. advanced waste processing, cleaner production, resource efficiency companies and associated advanced engineering technologies, would be willing to relocate to the study area in the form of:

- Work environments with closely controlled temperature requirements; or
- Spaces with high heating/cooling loads; or
- Industrial plants with high heating/cooling loads.

### 8.3 Strategic interventions

In order to shift from the “business as usual” scenario to the optimum development use mix, some strategic interventions by Bristol City Council and South Gloucestershire Council will be required. In energy terms these include:

- Collaborate in the implementation of the Bristol Development Framework Core Strategy Policy BCS4: Avonmouth and Bristol Port, the South Gloucester Core Strategy Policy CS35: Severnside and the South Gloucester Core Strategy Policy CS3: Renewable and low carbon energy generation, that support low carbon energy opportunities such as that presented by the district heating network in the study area.

- Study the feasibility of implementing the measures described in the Bristol Development Framework Core Strategy Policy BCS11: Infrastructure and Developer Contributions regarding the potential mechanisms for developers to contribute to the developments of an area by using planning obligations or a Community Infrastructure Levy that could be used to fund the district heating network.

- Apply the heat strategy described in the Bristol Development Framework Core Strategy Policy BCS14: Sustainable energy in the study area and the principles established in the South Gloucester Core Strategy
Policy CS4: Renewable or low carbon district heat networks to discuss in every planning application in the study area the possibility to connect to the proposed district heating network or to justify otherwise. A similar requirement is mentioned in the Core Strategies of other local authorities with existing heating networks such as Sheffield and Southampton.
9 Appendix

The following maps show the previously developed and greenfield land within the boundaries of the study area as well as the development options considered.
### Development of vehicular access (Amendment to previous permission)

<table>
<thead>
<tr>
<th>Ref</th>
<th>Date</th>
<th>Description</th>
<th>Address</th>
<th>Decision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>15340</td>
<td>09/03003/F</td>
<td>FULL 5.5 Development of a Mechanical Biological Treatment Facility</td>
<td>North Devon District Council - Chulmleigh, North Devon</td>
<td>27/01/2012</td>
</tr>
<tr>
<td>15517</td>
<td>15/01496/F</td>
<td>FULL 1.11 Development of an access to the site</td>
<td>between Kings Heath and Birmingham</td>
<td>13/07/1958</td>
</tr>
</tbody>
</table>

### Construction of an access road together with associated landscaping

<table>
<thead>
<tr>
<th>Ref</th>
<th>Date</th>
<th>Description</th>
<th>Address</th>
<th>Decision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>14923</td>
<td>09/00979/F</td>
<td>FULL 2.75 Construction of an access road</td>
<td>Land at Springfield School, Egham</td>
<td>26/07/2010</td>
</tr>
</tbody>
</table>

### Development of S.2 of land for the layout and construction of a distribution park

<table>
<thead>
<tr>
<th>Ref</th>
<th>Date</th>
<th>Description</th>
<th>Address</th>
<th>Decision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>15214</td>
<td>09/04470/F</td>
<td>FULL 8.3 The construction and operation of a Resource Recovery Centre,</td>
<td>Bristol</td>
<td>09/08/2011</td>
</tr>
<tr>
<td>15208</td>
<td>09/04076/F</td>
<td>FULL 17.4 Redevelopment of site to provide a chilled distribution</td>
<td>Bristol</td>
<td>03/03/2011</td>
</tr>
</tbody>
</table>

### Undetermined Applications

<table>
<thead>
<tr>
<th>Ref</th>
<th>Date</th>
<th>Description</th>
<th>Address</th>
<th>Decision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>15763</td>
<td>10/02547/F</td>
<td>FULL 6.6 Erection of 3 wind turbines associated bases and cables and control</td>
<td>Bristol</td>
<td>09/08/2011</td>
</tr>
<tr>
<td>15585</td>
<td>09/04802/F</td>
<td>FULL 3.22 COL for construction of facility for processing liquified petroleum</td>
<td>Bristol</td>
<td>03/03/2011</td>
</tr>
</tbody>
</table>

### Redevelopment of part of existing industrial site for a Bio-fuel

<table>
<thead>
<tr>
<th>Ref</th>
<th>Date</th>
<th>Description</th>
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<tr>
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### Development of a Low Carbon Energy Facility in connection with the existing Mechanical Biological Treatment Facility

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<td>15602</td>
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### Development of an area of 23.3 acres for the construction and operation of factories for the production of chemical and allied products etc.

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### Undetermined Applications

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<tr>
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### Undetermined Applications

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### Undetermined Applications

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### Development of 67 acres of land for the layout and construction of a distribution park

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### Undetermined Applications

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### Undetermined Applications

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<td>FULL 3.22 COL for construction of facility for processing liquified petroleum</td>
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## A066776 AVONMOUTH/ SEVERN SIDE STUDY
### MAP 1 - COMPLETED DEVELOPMENT (AT 2010)

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DATE
7th June 1995

IMPERIAL CHEMICAL INDUSTRIES Plc

- and -

NORTHAVON DISTRICT COUNCIL

- and -

AVON COUNTY COUNCIL

SEVERN SIDE

DEED OF AGREEMENT UNDER SECTION 106
OF THE TOWN AND COUNTRY PLANNING ACT 1990
RELATING TO DISTRIBUTION PARK PROPOSALS

Berwin Leighton
Planning & Environment Department
Adelaide House
London Bridge
London EC4R 9HA
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D Planning
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15.11 Legal Costs
15.12 Provisions of this Agreement enforceable by the County Council
15.13 Notification of dispositions
FIRST SCHEDULE - Agreed principles for the Overall Masterplan

1. Principal Structural Landscaping Framework
2. Rhine Drainage System
3. Highway Infrastructure
4. Ecological Corridors

SECOND SCHEDULE - Matters to be addressed by and agreed principles for the Ecological and Estate Management Plan ("the EEM Plan")

THIRD SCHEDULE -

Part I: Roads to be used by construction traffic

Part II: Roads to be avoided by construction traffic

PLANS
THIS DEED of AGREEMENT is made the 7th day of June 1995

BETWEEN

(1) IMPERIAL CHEMICAL INDUSTRIES PLC whose registered office is at
Millbank London SW1 and

(2) NORTHAVON DISTRICT COUNCIL of The Council Offices, Castle Street,
Thornbury, Bristol, BS12 1HS

(3) AVON COUNTY COUNCIL of Avon House The Haymarket Bristol BS99 7DE

RECITALS

A Definitions

A.1 Words and phrases used in this Agreement are defined in clause 2.1

B Interests in the Site

The Owner is the owner in fee simple of the Site

C Statutory Authority

C.1 The Council is the local planning authority for the purposes of
Section 1 Town and Country Planning Act 1990 for the area in which
the Site is situated

C.2 The County Council is the highway authority for the purposes of
the Highways Act 1980 for highways other than trunk and special
roads in the area in which the Site is situated
D Planning

D.1 On 24 May 1994 the Owner submitted the Access Application and the Development Application to the Council for determination.

D.2 The Council resolved to grant the Access Permission on 26 April 1995 and the Development Permission on 7 December 1994 on the understanding (inter alia) that the Owner first voluntarily enters into an appropriate legal agreement to provide for:

"(1) Revocation of elements of the claimed 1950s planning permission on the application site, and to the West of the proposed development area.

(2) Submission and approval of a Master Plan for all of the land in the applicant’s ownership including details of the following:-
   - Landscape framework
   - Drainage
   - Highways
   - Ecology

(3) Contributions to community forest and public access.

(4) Contributions to appropriate highway infrastructure.

(5) Use of waste heat from Seabank Power Station, where feasible.

(6) Provision of a set-aside area for ecological purposes (approximately 38 hectares) to service the whole of the ICI land holding.

(7) An ecological and estate management plan.

(8) Contribution/provision of publicly accessible art."
(9) Restriction on construction hours of working and traffic routes.

(10) Production of manual of practice for site management.

(11) Monitoring and maintenance of mitigation measures"

D.3 This Agreement provides for the matters referred to in Recital D2

E Planning Obligations

E.1 Subject to the provisions of Clause 3 (as to conditionality) this Agreement is intended:--

E.1.1 to create Planning Obligations for the purposes of Section 106 of the Town and Country Planning Act 1990 which are to be binding upon the whole or relevant part or parts of the Site

E.1.2 to be enforceable by the Council as local planning authority and

E.1.3 (subject to the provisions of Clause 15.12) to be enforceable by the County Council in its capacity as local highway authority

OPERATIVE PROVISIONS

1 PLANNING OBLIGATIONS

Subject to the provisions of Clause 3 (as to conditionality) this Agreement is intended:

1.1 to create Planning Obligations for the purposes of Section 106 of the Town and Country Planning Act 1990 which are to be binding upon the whole or relevant part or parts of the Site and

1.2 to be enforceable by the Council as local planning authority
1.3 (as to the provisions of the Clauses referred to in Clause 15.12) by the County Council as highway authority

2 INTERPRETATION

2.1 In this Agreement the following expressions (arranged in alphabetical order) shall unless the context otherwise requires have the following meanings

"the Access Application"
the application for full planning permission for the A403 Access submitted by the Owner on 24 May 1994 and given reference no P94/400/9

"the A403 Access"
an access road from the A403 and associated landscaping on land at Severnside

"the Access Planning Permission"
the planning permission pursuant to the Access Application

"the Account"
the Account referred to in Clause 11.3

"Agreement"
Deed of Agreement

"Approval"
also approval by the Council or (following call-in or appeal) by the Secretary of State for the Environment or a duly authorised person on his behalf following submission by (or on behalf and with the consent of) the Owner under the terms of a condition or conditions attached to the Development Permission
"Approved"
submitted by the Owner and approved by the Council or (following
call-in or appeal) by the Secretary of State for the Environment
or a duly authorised person on his behalf under the terms of a
condition or conditions attached to the Development Permission

"the Avonmouth/Severnside Development Strategy Area"
such area as is shown by a dot-dash line on Plan 1 of the Interim
Draft Avonmouth/Severnside Strategy August 1994 a copy of which is
attached to this Agreement

"Commercial Development"
development for a use falling within Class B8 of the Town and
Country Planning (Use Classes) Order 1987 or equivalent use under
a later replacement of that order

"Community Forest Areas"
such areas within the Site as may be identified in principle in
the Overall Masterplan for the natural regeneration of woodland
and/or wetland habitat types

"the Council"
the Northavon District Council and any successor authority to its
function as local planning authority for the area in which the
Site is situated

"the County Council"
Avon County Council and any successor authority to its function as
highway authority for roads (other than trunk or special roads)
for the area in which the Site is situated

"the Development"
the development of the Site by the layout and construction of a
Distribution Park (Class B8 of the Town and Country Planning (Use
Classes) Order 1987) on land at Severnside
"the Development Application"
the application for outline planning permission for the Development submitted by the Owner on 24 May 1994 and given reference no P94/400/8

"the Development Permission"
planning permission pursuant to the Development Application

"the Development Masterplan"
such masterplan as may from time to time be Approved

"the Dispute Resolution Procedure"
the procedure for resolving disputes under the terms of this Agreement as set out in Clause 15.9

"the East/West Link"
a road (including where appropriate verges footway(s) and cycleway(s)) (of such width and such standard as shall be Approved) to connect the Spine Road to the easternmost boundary of the Site and the western-most boundary of the M49 at the point marked "X" (the approximate location of the Edsleigh Farm Overbridge) on the Site Plan

"the Ecological and Estate Management Plan"
such plan as may from time to time be approved under the terms of Clause 5.2.2

"the Ecological Refuge Area"
such area as shall be identified under the terms of Clause 5.1.1

"the Expert"
such expert as shall for the purposes of the relevant dispute be agreed or (in default of agreement) nominated under the terms of Clause 15.9.1
"Gross External Area"
"Gross External Area" as defined in Paragraph 1 of the "Code of Measuring Practice" Fourth Edition published on behalf of the Royal Institute of Chartered Surveyors and the Incorporated Society of Valuers by Surveyors Holdings Limited

"Identified"
identified upon Approval of Reserved Matters pursuant to the Development Permission

"Interest"
interest at a rate not less than the rate from time to time at which sterling deposits are offered to the National Westminster Bank plc for seven days by Prime Banks in the London Interbanks Market for amounts equivalent to the balance outstanding to the credit of the relevant account

"Kings Weston Lane"
the road so named as indicated on the Merebank Plan

"the Kings Weston Lane Junction"
the junction indicated by a yellow circle on the Merebank Plan

"the Kings Weston Link Road"
the proposed road indicated by a blue line on the Merebank Plan

"LRT"
lightrail transit system

"the LRT Reserve"
such land as shall pursuant to Clause 7 be reserved for an LRT

"the M49"
the M49 motorway when constructed (the approximate location of which is indicated on the Plan)
"the M49 Junction"

a junction in a form and location to be agreed between the M49 Link and the M49 which may be a split or a northern all movements junction as generally indicated on the Plan

"the M49 Link"

the proposed link(s) between the Spine Road and the M49 in approximately the position(s) marked by a solid red line on the Plan

"the Merebank Permission"

the planning permission dated 21 September 1994 and bearing Bristol City Council Reference No 2014P/93N authorising the reclamation and development for industrial use to include B8 and open storage B2 rail freight depot and truck stop car auction and ancillary uses on the land edged red on the Merebank Plan

"the Merebank Plan"

the attached plan marked "Merebank Plan"

"Occupation"

beneficial occupation for the purpose for which the relevant building constructed was designed excluding occupation for the purpose of construction fitting out security maintenance marketing or repair

"Occupied"

occupied for the use for which the relevant building constructed was designed excluding occupation for the purpose of construction fitting out security maintenance marketing or repair

"the Overall Masterplan"

such masterplan as may from time to time be approved under the terms of Clause 4.4
"the Overall Masterplan Area"
the area referred to in Clause 4.1

"the Owner"
Imperial Chemical Industries Plc aforesaid

"the Owner's Land to the South"
that land belonging to the Owner which is edged blue (for illustrative purposes only) on the Site Plan

"the 1957 Planning Permission"
the planning permission dated 27th November 1957 relating to (inter alia) the Site authorising

(i) the development of an area of 1,000 acres

(a) for the construction and operation of factories for the production of chemical and allied products (including non-ferrous metals) and

(b) for the development mentioned in sub-paragraphs (ii) and (iii) hereof

(ii) the development within an area of 545 acres consisting of

(a) the construction and operation of offices warehouses stores reservoirs pumphouses canteens clubs hostels training establishments amenity and welfare buildings sports pavilion and sports playing fields and

(b) the development mentioned in sub-paragraph (iii) hereof
(iii) the development within an area of 1,100 acres consisting of the construction and operation of any buildings structures erections or engineering works expedient for an ancillary to the construction and operation of the factories mentioned in paragraph (i) above other than building structures or erections in which actual processes of manufacturer are carried on

(iv) the change of use of Hock Farm and Severn Farm to office and/or residential hostel and club purposes

(v) permission to construct accesses to existing public highways

"the Plan"
the plan attached to this Agreement and marked "the Plan"

"Public Art"
shall include but not be limited to the provision of hard and soft landscaping planting water features stained glass iron railings and gates ceramic tiling murals paving design street furniture signage banners and flags and interior works including textiles paintings photographs furniture and pots

"Relevant Parts"
part of the Overall Masterplan referred to in Clauses 4.2.1 4.2.2 4.2.3 or 4.2.4

"Reserved Matters"
details of siting reserved under the terms of the Development Permission for subsequent Approval

"Seabank Power Station"
the gas fired power station proposed for the area indicated on the Plan as "Seabank Power Station"
"the Second Carriageway Reserve"
such land as shall pursuant to Clause 6.5 be reserved for the
second carriageway of the Spine Road

"the Site"
the area shown (for the purposes of illustration only) edged red
on the Site Plan

"the Site Plan"
the plan attached to this Agreement marked "Site Plan"

"the Spine Road"
such road (including where appropriate verges footway(s) and
cycleway(s)) as may be Identified for the purpose (inter alia) of
performing the function of the principal distributor road for the
Development and development on the Owners' Land to the South and
potentially of a County primary route (including access to the M49
Link) and distributor road leading to land beyond the Owner's Land
to the South

"Successor(s) in Title"
successor(s) in title and person(s) deriving title through or
under the Owner to any part or parts of the Site

2.2 References to any Recital Clause Schedule Paragraph (or any part
of any of them) shall (unless the context otherwise requires) be
references to a recital clause schedule or paragraph (or any part
of any of them) of this Agreement

2.3 References to the masculine gender shall include the feminine
gender and vice versa

2.4 Unless the context otherwise requires references to the singular
shall include the plural and vice versa
2.5 Headings are for ease of reference only and are not intended to be construed as part of this Agreement

2.6 A reference to the Owner shall (as appropriate) include or constitute reference to Successors in Title

3 CONDITIONALITY

3.1 All obligations of the Owner under the terms of this Agreement are conditional upon

3.1.1 the grant by the Council of both the Development Permission and the Access Permission and

3.1.2 commencement of the Development pursuant to the Development Permission as construed in accordance with Clause 15.1

3.2 Any obligation of the Owner expressed to be subject to or conditional upon a particular event shall not take effect unless and until the relevant event has occurred

4 OVERALL MASTERPLAN

4.1 Area

The Overall Masterplan shall relate to the Site and to other areas owned by the Owner within the area shown edged by a broken red line (for illustrative purposes only) on the Plan.

4.2 Scope

The Overall Masterplan shall address (in outline and not in detail) the following principles for the Overall Masterplan Area

4.2.1 (with the objective of establishing a structure for the emerging landscape) the principal structural landscaping framework
4.2.2 (with the objective of maintaining the integrity of the rhine drainage system as well as ensuring an efficient economical drainage system in connection with the Development and development of other areas within the Overall Masterplan Area) the principal elements of surface water drainage infrastructure to be provided and/or maintained as the area is developed.

4.2.3 the principal elements of highways infrastructure including footpaths and bridleways the approximate location of principal access roads and the Spine Road and (in relation to the Spine Road) principles concerning design and number and locations of junctions having regard to the proposed function of the Spine Road as a road serving the function of a County primary route.

4.2.4 (with the objective of establishing a network of wildlife corridors and sites of semi-natural habitat to link to the Ecological Refuge Area) the approximate location of corridors to be maintained by virtue of their ecological value.

4.3 Matters deemed to be approved for the purposes of the Overall Masterplan

For the purposes of the Overall Masterplan the following principles shall be deemed to have been approved under the terms of Clause 4.4

4.3.1 the principles set out in the First Schedule

4.3.2 matters Approved as part of the Development Masterplan and any Approved variations of/or substitutions for the Development Masterplan

4.3.3 (at the Owner’s election) any matter relating to the Overall Masterplan decided by the Expert under the Dispute Resolution Procedure
4.4 Mechanics for approval

4.4.1 Proposals for the Overall Masterplan shall be submitted to the Council by the Owner for approval no later than proposals for the Development Masterplan are submitted to the Council for Approval under the terms of the Development Planning Permission.

4.4.2 Before giving any approval under Clause 4.4.1 the Council shall consult the County Council (in its capacity as highway authority for the area) as to those elements of the Overall Masterplan referred to in Clause 4.2.3 and shall prior to making a decision take into account such reasonable representations as the County Council may make.

4.4.3 If the proposals for the Overall Masterplan or a Relevant Part of it have not been approved by the Council within eight weeks of submission (including such level of detail as the Council may reasonably require) the Owner may invoke the Dispute Resolution Procedure in relation to the Overall Masterplan Relevant Part or level of detail required by the Council.

4.5 Variation of Overall Masterplan

4.5.1 the Owner may from time to time request that the Overall Masterplan be substituted or varied in whole or in part and the provisions of this Clause 4 shall apply (mutatis mutandis) to any such proposals for variation or substitution and to any revisions to the Overall Masterplan or any substitute for it as may be approved as part of that process.

4.5.2 the Overall Masterplan including any variation of (or substitution for) it shall be deemed from time to time to be varied so far as may be necessary to give effect to any Approval granted under the terms of the Development Permission and any other planning permission granted pursuant to an application submitted by the Owner and relating to the Site.
5.1 Ecological Refuge Area

5.1.1 An area of approximately 38 Hectares (from within the area of search shown edged green on the Site Plan and which shall include the two core areas shown hatched green on the Site Plan) shall be identified under the terms of the Overall Masterplan and the Ecological and Estate Management Plan as a nature sanctuary with the objective of providing a fixed area of land capable of sustaining the general biodiversity of the Overall Masterplan Area free from disturbance.

5.1.2 The Ecological Refuge Area shall in so far as practicable be protected from intrusion and disturbance with the aim of satisfying the objectives referred to in Clause 5.1.1 save to the extent specified in such Ecological and Estate Management Plan as may from time to time be approved under the terms of this Agreement.

5.1.3 The Ecological Refuge Area may at the Owner's discretion be transferred (subject to the provisions of Clause 5.1.2) to an appropriate nature conservation body in full and final discharge of all and any obligations that the Owner may have in relation to such area under the terms of this Agreement.

5.2 Ecological and Estate Management Plan

5.2.1 Principles already approved

Principles that have been approved by the Council for the purposes of the Ecological and Estate Management Plan are set out in the Second Schedule.
5.2.2 Mechanics for approval

5.2.2.1 No later than the submission of proposals for the Development Masterplan under the terms of the Development Planning Permission for Approval the Owner shall submit to the Council proposals for the Ecological and Estate Management Plan which are consistent with the proposals set out in the Second Schedule.

5.2.2.2 The provisions of Clauses 4.3 to 4.5 (inclusive) in relation to the Overall Masterplan shall (mutatis mutandis) apply to approvals variation and substitution of the Ecological and Estate Management Plan.

5.2.3 Areas to be subject to the Ecological and Estate Management Plan

The areas which are to be subject to the requirements of the Ecological and Estate Management Plan shall be identified and shall be limited to:

5.2.3.1 the principal structural landscape features and ecological corridors as shown indicatively on the Plan.

5.2.3.2 existing agricultural areas within the Overall Masterplan Area.

5.2.3.3 new habitats and advanced landscape planting proposed as part of the Development.

5.2.4 Duties following approval of the Ecological and Estate Management Plan

Following approval of the Ecological and Estate Management Plan the Owner shall manage the areas to which it relates and monitor its efficacy generally in accordance with the terms of the Ecological and Estate Management Plan.
5.3 Community Forest

The Owner shall lay out and plant the Community Forest Areas in accordance with such timescale and such principles as may from time to time be Approved as part of the landscape framework for the Development.

6 SPINE ROAD AND EAST/WEST LINK

6.1 Location

6.1.1 The location of the Spine Road and the East/West Link shall be identified and shall generally accord with the location for the Spine Road established under the terms of the Overall Masterplan.

6.1.2 For the avoidance of doubt as part of the Approval process for the purposes of Clause 6.1.1 the Council shall consult the County Council in its capacity as highway authority and shall prior to making a decision take into account such reasonable representations as the County Council may make.

6.2 Highways Agreement

6.2.1 The Spine Road and the East/West Link shall be constructed under the terms of appropriate agreements with the highway authority for the area in which the Site is situated.

6.2.2 The terms of the agreements shall be such reasonable terms as the Owner and the County Council as highway authority agree.

6.2.3 If the Owner and the County Council are unable to agree terms for any agreement either may refer all or any terms of the proposed agreement to the Expert under the terms of the Dispute Resolution Procedure and the County Council and the Owner shall be bound by the Expert's decision.
6.3 Adoption

6.3.1 The Spine Road shall be built to such specification as is necessary for the function which the road is to serve and shall be offered for adoption by the Owner not later than the date at which each end of the Spine Road (whether dual or single carriageway) connects directly to a public highway open to all vehicles and directly serves areas outside the Site.

6.3.2 The East/West Link shall be offered for adoption by the Owner upon its substantial completion and being opened to through traffic from both the Spine Road and areas to the East of the M49.

6.3.3 Subject to the terms of the relevant adoption agreement having been observed and performed the County Council shall upon the Owner offering the whole or any section of the Spine Road or the East/West Link for adoption do such acts or things as are necessary for the whole or relevant section to be adopted as a public highway maintainable at public expense.

6.4 Phasing of Construction of First Carriageway of the Spine Road

The first carriageway of the Spine Road shall be constructed in phases corresponding to the progress of the Development southward from the A403 to the intent that:

6.4.1 the Owner shall not be required to construct any carriageway of the Spine Road beyond the northernmost boundary of the area or phase of the Development which it is to serve unless the access to such phase or area is to the south of the northernmost boundary of that phase or area in which case the first carriageway of the Spine Road shall be constructed up to such accessway.
6.4.2 no building forming part of any phase or area of the Development shall be Occupied before that part of the first carriageway of the Spine Road which serves the road off which the access to that building is taken has been constructed

6.5 Second Carriageway of the Spine Road

6.5.1 The Owner shall reserve for the purposes of future construction of a second carriageway of the Spine Road until 1st January 2016 (or it earlier becoming apparent that the second carriageway of the Spine Road will not be required) a strip of land (the width of which shall not exceed the minimum reasonably necessary to provide the second carriageway of the Spine Road) in a location to be Identified alongside the first carriageway of the Spine Road southward of its junction with the East/West Link

6.5.2 During such time as land is reserved pursuant to Clause 6.5.1 it shall not be used in such a way as would preclude later performance of the obligations contained in Clause 6.5.3

6.5.3 The Owner shall construct (within 24 months of the satisfaction (if the same shall occur prior to 1 January 2016) whichever is the later of the conditions in Clauses 6.5.3.1 and 6.5.3.2 to be satisfied) the second carriageway of the Spine Road within the Second Carriageway Reserve subject to:-

6.5.3.1 traffic volumes having grown on the Spine Road (as a result of (a) buildings constituting Commercial Development within the Overall Masterplan Area having been Occupied and (b) the M49 Junction having been completed and opened for use) to such an extent as to require the provision of such carriageway on highway capacity or highway safety grounds and

6.5.3.2 the Owner having procured any necessary Approvals and other necessary statutory consents on terms which are not unreasonable
(it being agreed between the parties that for the purposes of Clauses 6.5.3.1 and 6.5.3.2 in the event of their disagreeing whether the second carriageway is required on highway safety or highway capacity grounds or any terms are unreasonable the subject of their disagreement may be referred to the Expert under the Dispute Resolution Procedure by any of them and each shall be bound by the Expert's decision)

6.5.4 The detailed location of the whole or any part of the Second Carriageway Reserve may from time to time until the second carriageway of the Spine Road has been built be varied at the Owner's election subject to

6.5.4.1 such variations being consistent with such Development Masterplan and any relevant Approvals of reserved matters under the terms of the Development Planning Permission or any subsequent planning permission as may in any case at the relevant time have been Approved and

6.5.4.2 the location which is to be varied not being alongside to a section of the first carriageway of the Spine Road which has already been constructed

6.5.5 The Owner may (subject to the location and the specification first having been approved by the highway authority) from time to time lay services and service conduits and infrastructure under the Second Carriageway Reserve

6.5.6 The Owner shall not be required to create a greater interest in the Second Carriageway Reserve than is essential for the construction operation or use of the Spine Road and shall retain all other rights in over and under the land the subject of the land upon which the Spine Road has been constructed
6.6 **East/West Link**

6.6.1 The Owner shall construct the East/West Link prior to the date of Occupation of the last phase of the Development to be Occupied or earlier Occupation of 2 million square feet (185,800 square metres) Gross External Area of Commercial Development forming part of the Development.

6.6.2 No part of the last phase of the Development to be Occupied or Commercial Development the Gross External Area of which (when added to the Gross External Area of Commercial Development already Occupied as part of the Development) exceeds 2 million square feet (185,800 square metres) shall be Occupied until the East/West Link has been opened to traffic.

6.7 **Construction by the County Council**

6.7.1 At any time (prior to 1 January 2016) after the M49 Junction or the East/West Link has been completed and opened to the public and in the case of the East/West Link been opened to through traffic from both sides of the M49 the County Council may serve notice in writing upon the Owner stating that it wishes to construct or to fund the construction to the Southern boundary of the Site of such parts of the first carriageway of the Spine Road and/or the second carriageway of the Spine Road as have not as at that date been constructed by the Owner.

6.7.2 If notice is served on the Owner pursuant to Clause 6.7.1 (prior to 1 January 2016) the Owner shall (subject to the County Council first undertaking to maintain such parts of the Spine Road at public expense) upon substantial completion of those parts of the Spine Road completed following such notice dedicate the land within the Site upon which such parts of the Spine Road have been constructed as public highway.
6.7.3 Within 56 days of receipt of notice from the County Council pursuant to Clause 6.7.1 the Owner may elect either

6.7.3.1 to undertake the detailed design and to construct the relevant parts of the Spine Road and to charge the cost of so doing to the County Council commensurately with the rate at which the Owner is obliged to pay its own design consultants and contractors or

6.7.3.2 to permit the County Council to design and construct the relevant parts of the Spine Road at no cost to the Owner

6.7.4 If the Owner fails to make any election under Clause 6.7.3 it shall be deemed to have elected pursuant to Clause 6.7.3.2

6.7.5 If the Owner elects pursuant to Clause 6.7.3.1 the County Council shall be obliged to give a deed of indemnity to the Owner (in such form as the Owner may reasonably require) to cover all costs incurred by the Owner in designing or constructing the relevant parts of the Spine Road but such parts shall be designed and constructed to the County Council’s reasonable approval in the manner contemplated by Clause 6.2

6.7.6 If the Owner elects pursuant to Clause 6.7.3.2

6.7.6.1 the relevant parts of the Spine Road shall not be constructed otherwise than in the location Approved or to a layout other than that Approved

6.7.6.2 the Owner shall grant to the County Council a licence to enter on to such parts of the Site as may be reasonably necessary to facilitate the construction of the relevant part of the Spine Road and which are approved by the Owner
6.7.6.3 the licence referred to in Clause 6.7.5.2 shall contain such terms as the Owner may reasonably specify for the purpose of protecting the amenity and marketability of those parts of the Development in the vicinity of the areas of the Site upon which works will be undertaken

6.7.6.4 the County Council shall construct as part of the construction of the relevant part of the Spine Road such conduits and service media (including manholes culverts and draw-pits) in such locations and to such specification as the Owner may reasonably require

6.7.6.5 the County Council shall consult the Owner with reference to the detailed design of the relevant part of the Spine Road

6.7.6.6 the County Council shall not construct the relevant part of the Spine Road other than in accordance with a programme first approved by the Owner (approval not to be unreasonably withheld or delayed)

6.7.6.7 the County Council shall indemnify the Owner against all liability losses costs claims demands directly or indirectly sustained by the Owner arising as a result of the construction of the relevant part of the Spine Road save insofar as and to the extent that the same may result from the default or negligence of the Owner

7 LIGHT RAIL TRANSIT RESERVE

7.1 The LRT Reserve shall comprise land not exceeding 9.5 metres in width alongside either the Second Carriageway Reserve or the first carriageway of the Spine Road in a position to be Identified

7.2 The Owner shall until 1st January 2016 (or such earlier date upon which any proposals for the construction of an LRT in such area are abandoned) reserve the LRT Reserve for the purpose of a future...
LRT serving the Development Site and linking to such other centres of population as may be approved by the Owner (approval not to be unreasonably withheld or delayed)

7.3 The provisions of Clause 6.5.2, 6.5.4 to 6.5.6 (inclusive) and 6.7 shall mutatis mutandis apply to the LRT Reserve save that:-

7.3.1 references to the Spine Road and the Second Carriageway Reserve shall be replaced by references to the LRT and the LRT Reserve and

7.3.2 in clause 6.7:-

7.3.2.1 all references to the first carriageway of the Spine Road shall be deleted

7.3.2.2 the Owner shall not be obliged to permit commencement of construction of the LRT unless the County Council warrants that sufficient funding has been procured for its completion and operation

7.3.2.3 references to the County Council (save in respect of Clause 7.3.2.2, 7.3.2.4 and 7.3.2.5) shall be replaced by references to the County Council or such body (of sound financial status) as it shall elect for the purposes of constructing the LRT on its behalf

7.3.2.4 the Owner shall not in Clause 6.7.2 be obliged to dedicate land as public highway but merely to create in favour of the County Council at a consideration of One Pound (£1) such interest in the Site as is necessary to comply with Clause 6.5.6 and

7.3.2.5 there shall be deemed to be included a new Clause 6.7.6 under which if the LRT ever falls into disuse the County Council shall be obliged at no cost to the Owner (a) to the Owner's reasonable satisfaction to remove all structures apparatus track and machinery constructed as part of the LRT and to reinstate the LRT Reserve to no worse state and condition than applied prior to
commencement of construction of the LRT and (b) (unless the County Council is unable having used its best endeavours to create legal relations with the LRT operator to enable it so to do) to revest in the Owner any land interest created in respect of the LRT and/or the LRT Reserve pursuant to Clause 6.7.2

8 CONTRIBUTION TOWARDS KINGS WESTON LANE IMPROVEMENTS

8.1 The obligation under Clause 8.2 shall apply subject to

8.1.1 all Commercial Development authorised under the terms of the Merebank Permission having been Occupied prior to 1st January 2001 and

8.1.2 Neither the M49 Junction nor the Kings Weston Link Road having been constructed at the date that the last of such Commercial Development is Occupied and

8.1.3 all Commercial Development forming part of the Development having been Occupied

8.2 the Owner shall pay to the County Council the sum of £20,000 toward any sums incurred after the date of this Agreement by the County Council toward the construction of road improvements designed

8.2.1 to bring about a material increase in the capacity of the Kings Weston Lane Junction or

8.2.2 a material increase in the capacity or safety of any other roads which will benefit the Development the details of which are first agreed between the Owner and the County Council

8.3 the County Council shall not apply any monies received pursuant to Clause 8.2 otherwise than toward the road improvements referred to in Clause 8.2.1 and 8.2.2.
all monies paid to the County Council shall be held in an Interest bearing account with a bank first approved by the Owner

all interest earned or monies held in the said account shall be accumulated with capital held on the account

the County Council shall not withdraw monies from the account other than for the purpose referred to in Clause 8.3

on the fifth anniversary of payment to the County Council all monies held by the County Council and not expended for a purpose specified in Clause 8.2 shall be returned to the Owner together with all accrued interest

TRANSPORTATION STUDY

The Owner shall within twenty-eight days of the date that development is commenced (within the meaning of Clause 15.1) pursuant to the Development Permission contribute to the County Council Eight Thousand Five Hundred Pounds (£8,500) or such lesser sum as shall represent 25% of the cost of a study to examine proposals for public transport links between the Development Avonmouth and Bristol City Centre

The sum referred to in Clause 9.1 shall not be payable until the transportation study has been commissioned by the County Council and the County Council has agreed that:

in return for a reasonable contribution in excess of the 25% referred to in Clause 9.1 (sufficient to meet the full cost of any additional work) the County Council shall require the consultant producing the study to address such additional proposals and/or issues as the Owner may reasonably specify and

a full copy of the consultant’s report shall be provided to the Owner within seven days of receipt by the County Council
OVERALL IMPROVEMENTS TO HIGHWAYS INFRASTRUCTURE

10.1 The Owner the Council and the County Council will (along with other landowners in the area who would benefit) in good faith participate in discussions with the objectives of reaching agreement concerning:

10.1.1 the provision of additional highway infrastructure (including access to and egress from the M49) to serve the Avonmouth/Severnside Development Strategy Area

10.1.2 the design location timescale of such infrastructure and what is to trigger its provision and

10.1.3 an equitable means by which the cost (including land costs) of construction of such infrastructure can be divided between those who will benefit from it.

10.2 The Owner the Council and the County Council will each act in good faith, both in terms of the initial discussions and in the negotiation of any associated documentation, without prejudice to the Owner’s duty to shareholders and the Council’s responsibilities as planning authority and the County Council’s responsibilities as highway authority.

10.3 The Owner the Council and the County Council each agree that

10.3.1 it will be an objective of the discussions referred to in Clause 10.1 that when the funding formula is agreed between the parties and other landowners in the area it shall apply to all land within the Avonmouth/Severnside Development Strategy Area

10.3.2 when the funding formula is agreed it shall apply (inter alia) to the Site
10.3.3 the formula when agreed shall have regard to traffic generated by land uses within the Avonmouth/Severnside Development Strategy Area

10.3.4 the formula when agreed shall credit against any contribution which the Site may be agreed to bear the cost (including land costs) to the Owner of the Spine Road and the East/West Link provided as part of or contemporaneously with the Development

10.3.5 they shall each endeavour in good faith to draw into the discussions referred to in Clause 10.1 each significant landowner within the Avonmouth/Severnside Development Strategy Area

10.4 The Owner the Council and the County Council will each enter into such documentation with other landowners as may be necessary or appropriate to give effect to such arrangements as may be agreed as a result of the discussions referred to in Clause 10.1

11 PUBLICLY ACCESSIBLE ART

11.1 The Owner shall contribute up to One Hundred Thousand Pounds (£100,000) toward Public Art which unless otherwise agreed shall be located on the Site and shall be provided according to the principles set out in this Clause 11

11.2 Upon each building forming part of the Development being Occupied the Owner shall pay Five Hundred Pounds (£500) per complete 1000 square metres (Gross External Area) of that building into the Account until (without prejudice to the maximum amount referred to in Clause 11.1 only being payable if the Development in its entirety is Occupied) the amount referred to in Clause 11.1 has been paid in total

11.3 The Owner shall within 28 days of commencement of construction of the first building comprising not less than 5,000 square metres (Gross External Area) open an Interest bearing account with
Lloyds Bank Plc or such other bank as the Owner and the Council may agree in the joint names of the Owner and the Council on terms that sums may only be withdrawn from the account by joint request.

11.4 All monies contributed by the Owner under Clause 11.2 shall be paid into the Account.

11.5 All interest earned on deposits shall accrue to the Account and shall be subject to the same terms as principal sums held on the account.

11.6 Monies held in the Account may not (subject to the provisions of Clause 11.10) be applied otherwise than towards Public Art which is agreed by the Owner and the Council acting reasonably or the reasonable expenses of administering competitions for the purposes of selecting particular items of Public Art.

11.7 The Owner and the Council and/or their respective representatives shall meet regularly after the Development has commenced to endeavour in good faith to identify projects to which funds held on the account may be applied.

11.8 In the event of a dispute between the Owner and the Council as to whether a particular project or proposal constitutes Public Art within the meaning of this Agreement or whether it is an appropriate subject for expenditure pursuant to this Agreement, either the Council or the Owner may (without prejudice to the Owner's right to veto the construction location or creation of any element of Public Art on the Site) after 14 days have elapsed invoke the Dispute Resolution Procedure.

11.9 The Expert's decision shall be binding on the parties and the Council shall sign any necessary notice of withdrawal within 10 days of request from the Owner.
11.10 All monies outstanding to the Account and not paid toward Public Art or administration of competitions as anticipated by Clause 11.6 prior to the fifth anniversary of Occupation of the last building forming part of the Development to be Occupied under the terms of the Development Permission shall be repaid (along with all accrued interest) to the Owner and the Account shall be closed.

12 THE 1957 PLANNING PERMISSION

12.1 Land Areas

The Owner will not develop the area shown edged red on the Site Plan under the terms of the 1957 Planning Permission.

12.2 Estuarine Area

The Owner will not implement any part or parts of the 1957 Planning Permission which are as yet unimplemented within the Estuary "Buffer Zone" (being one of the areas indicated by green tinting on the Plan) or the area to the West and North West of the A403 insofar as such implementation would cause significant harm to the Severn Estuary SPA and could not be mitigated to an extent to which implementation would not be contrary to the EC Habitats Directive (92/43/EEC).

13 WASTE HEAT FROM SEABANK POWER STATION

13.1 If Seabank Power Station (or any other new power station within 1.2 kilometres of any boundary of the Site) is constructed within 10 years of the date of this Agreement the Owner will examine the practicability of using its waste heat and exhaust gases to provide heat for the Development.

13.2 The examination referred to in Clause 13.1 will have regard (inter alia) to
13.2.1 infrastructure and long term maintenance and operational costs

13.2.2 practicability of supply

13.2.3 unit cost for energy and

13.2.4 feasibility of achieving a realistic commercial return on capital employed

13.3 If the examination referred to in Clause 13.1 indicates the supply of waste heat in principle to be practicable and commercially viable the Owner will explore with existing and potential future occupiers of the Development ways in which all or part of their heating requirements can be met by such supply

14 CONSTRUCTION HOURS AND TRAFFIC ROUTING

14.1 During the construction of the Development construction traffic shall be encouraged to use those roads listed in part 1 of the Third Schedule and discouraged from using those roads listed in part 2 of the Third Schedule when driving to and from the Site

14.2 The Owner shall require of contractors employed by the Owner that they adhere in so far as practicable to the arrangements referred to in Clause 14.1

14.3 Unless otherwise agreed between the Council and the Owner the Owner shall prohibit construction works generating noise materially above background levels (Leq) (as measured at the facade of the nearest house (outside the Site) to the relevant construction activity or material levels of traffic on roads in the vicinity of the Site between the hours of 7.00 pm and 7.00 am Mondays to Fridays and between the hours of 8.00 pm and 7.00 am on weekends and public holidays
MISCELLANEOUS AND GENERAL PROVISIONS

15.1 Commencement of Development

15.1.1 Irrespective of the provisions of Section 56(4) Town and Country Planning Act 1990 none of the following operations shall constitute a material operation for the purposes of commencement of development pursuant to the Development Permission

15.1.1.1 any works pursuant to the Access Permission;

15.1.1.2 laying of services and service media

15.1.1.3 construction of boundary fencing or hoardings

15.1.1.4 construction of temporary accesses and/or highway works

15.1.1.5 construction of foundations

15.1.1.6 archaeological investigations

15.1.1.7 landscaping works

15.1.1.8 noise attenuation works

15.2 No Fetter of Discretion

15.2.1 Except insofar as legally or equitably permitted this Agreement shall not prejudice fetter or affect the exercise of any statutory power duty or discretion of the Council or the County Council
15.3 Lapse Revocation or Modification of the Development Permission

15.3.1 This Agreement shall lapse and all entries relating to it on the Register of Local Land Charges and the Register of Title of the Site or (in the event of the type of development anticipated by Clause 15.3.1.4 occurring) the relevant part of the Site shall be deleted if the Development Permission

15.3.1.1 shall lapse without having been implemented

15.3.1.2 shall be revoked or

15.3.1.3 shall be modified other than at the request or with the consent of the Owner or

15.3.1.4 if the Owner shall beforecommencing the Development pursuant to the Development Permission on the relevant part of the Site implement any subsequent planning permission for the permanent development of that part of the Site which is inconsistent with the Development Permission

15.4 Notices

15.4.1 That any notice or other written communication to be served or given by one party upon or to any other under the terms of this agreement shall be deemed to have been validly served or given if transmitted by facsimile delivered by hand or sent by registered or recorded delivery post to the party upon whom it is to be served or to whom it is to be given as specified in Clause 15.4.2 or as otherwise notified for the purpose by notice in writing

15.4.2 The address for any notice or other written communication is (unless otherwise notified in writing by the relevant party)

15.4.2.1 for the Council as specified above marked for the attention of the Chief Executive Officer or Head of Paid Services

tjp/1213/1/g2
15.4.2.2 for the County Council as specified above marked for the attention of the Chief Executive Officer or Head of Paid Services

15.4.2.3 for the Owner as specified above marked for the attention of the Company Secretary

15.4.3 any notice or other written communication to be given by the Council shall be deemed valid and effectual if it is signed on behalf of the Council by an officer or duly authorised signatory of it

15.5 Land Ownerships

15.5.1 Nothing in this Agreement shall require the performance of any obligation whatsoever in upon over or under land outside the ownership of the person to perform the obligation

15.6 Parting with Interests in the Site and Successors in Title

15.6.1 (Save in respect of Clause 10) the Owner shall upon parting

15.6.1.1 with the fee simple in any part of the Site be released from all obligations and duties under the terms of this Agreement insofar as they relate to or are binding on that part of the Site

15.6.1.2 with the entirety of its interest in the Site as a whole be released from all liabilities whatsoever under the terms of this Agreement

15.6.2 The releases provided for in Clause 15.6.1 shall not apply to any prior or existing breach as at the date of disposal

15.6.3 Any Successor in Title to any part of the Owner's interest which is no greater than that of the Owner or occupier of an individual building or any part of an individual building within the Development shall not be bound by or incur any liability in
respect of any of the obligations of the Owner under this Agreement except insofar as and to the extent that the relevant obligation is a restriction on Occupation of the building in which such interest exists

15.6.4 No Successor in Title to the Owner shall be liable under the terms of any obligation under this Agreement which is not directly referable to land of which he is a successor

15.7 Discharge by Performance

Upon the performance discharge or other fulfilment of the obligations (or any of them) of the Owner under the terms of this Agreement such covenant obligation or obligations shall absolutely cease and determine save in respect of any antecedent breach.

15.8 Consents and Approvals

Where the approval agreement or consent of the Council the County Council or any officer of either is required for any purpose under or in connection with the terms of this Agreement unless specified to the contrary such approval agreement or consent shall not be unreasonably withheld or delayed (and the party from whom the relevant approval agreement or consent which has been unreasonably withheld shall not be liable for a consequential breach of its obligations).

15.9 Dispute Resolution

15.9.1 The expert shall be a person with acknowledged expertise in the subject matter of the dispute and in the event that the parties cannot agree his identity within two weeks of the right to refer the matter to the expert arising either may require that he be nominated by the President for the time being of the Royal Institution of Chartered Surveyors
15.9.2 the parties shall use best endeavours to appoint the Expert (whether agreed between the parties or nominated by the President for the time being of the Royal Institution of Chartered Surveyors) within one calendar month of the date of the right to refer the matter to the Expert having arisen

15.9.3 it shall be a specific term of the appointment of the Expert that he is to reach his decision within one calendar month of the date of his appointment and that he is to set a timetable for each of the steps specified in Clauses 15.9.5 to 15.9.7 (inclusive) to be complied with

15.9.4 the costs of the Expert shall be in the award of the expert and his decision shall be final and binding on the parties save in the case of manifest error

15.9.5 the Expert shall require each party to deliver to him and each other written submissions on their respective opinions as to the matter in dispute

15.9.6 each party shall have the opportunity to deliver to the Expert and to each other written counter submissions

15.9.7 after the delivery of counter submissions or (if none) after submission of written submissions no party shall be entitled to make any further submissions and the Expert shall forthwith deliberate and deliver to each party his decision in accordance in writing within a reasonable time of closing submissions or counter submissions

15.9.8 the Expert shall be restricted in settling the dispute to choosing between one or other of the proposals put to him by the Owner or the Council or elements compatible with one another from the submissions of either party
15.10 Registration as a local land charge

This Agreement shall be registered as a local land charge

15.11 Legal Costs

The Owner shall within 14 days of completion of this Agreement

15.11.1 pay to the Council the Council’s reasonable and proper legal fees incurred in connection with the negotiation and drafting of this Agreement in the sum of

15.11.2 pay to the County Council the County Council’s reasonable and proper legal fees incurred in connection with the negotiation and drafting of this Agreement in the sum of One Thousand Five Hundred Pounds (£1,500)

15.12 Provisions of this Agreement enforceable by the County Council

The County Council shall have the benefit of and be entitled to enforce Clauses 4.4.2 6.1.2 6.2 6.3 6.4 6.5 6.6 6.7 7 8 9 10 and 15.11.2

15.13 Notification of dispositions

The Owner shall from time to time

15.13.1 within 28 days of each relevant disposal notify the Council and the County Council of any disposal by the Owner of any freehold interest or leasehold interest for a term of more than twenty one years in the Site
15.13.2 within 28 days of a written request from the Council County and/or the Council notify the County Council and/or the Council (as appropriate) of such details as the Owner has available to it of the identity of the person or persons occupying any relevant part of the Site.

DELIVERED AS A DEED BY ALL PARTIES ON THE DATE OF THIS DOCUMENT
KEY:

THE SITE
AREA SUBJECT TO ACCESS PERMISSION
OWNER'S LAND TO THE SOUTH
AREA SUBJECT TO 1957 PLANNING PERMISSION
AREA OF SEARCH FOR ECOLOGICAL REFUGE AREA (CORE AREA OF 28 HECTARES SHOWN HATCHED)
CONNECTING POINT OF EAST-WEST LINK "X"

THE SITE PLAN

ICI

North
WESTERN
APPROACHES
APRIL 1995
10371/0106/020
FIRST SCHEDULE

Agreed principles for the Overall Masterplan

1 Principal Structural Landscaping Framework

1.1 The principal structural landscaping framework shall include those areas and corridors illustrated on the Plan as to be retained and managed for their ecological value but otherwise shall define only those areas intended to be outside individual development plots on completion of the development and either alongside principal roads or within areas to be designated solely for landscape purposes.

1.2 Details of landscaping of a non-structural landscaping nature within development areas will not be required for or form part of the Overall Masterplan.

2 Rhine Drainage System

2.1 The rhines the general integrity of which are to be maintained (albeit that they may be significantly rerouted and their banks may if necessary be modified) are as indicated by blue lines on the Plan.

2.2 With the exception of the rhines referred to in Paragraph 2.1 all other rhines may be realigned culverted and/or infilled to accommodate development, provided the overall integrity of the rhine drainage system is maintained.

2.3 The landscape treatment of the rhines referred to in Paragraph 2.1 shall be as outlined in paragraph 6.8.13 and Figure 6.4 of the Environmental Statement which accompanied the Development Application.
2.4 There shall be safeguarded for maintenance access purposes an area which shall not be required to extend more than 8 metres on one side of the centre line of the channel of the relevant rhine.

3

Highway Infrastructure

3.1 All development areas will be served (directly or indirectly) from a distributor road ("the Spine Road") running west of the M49 south from the A403 Access to Severn Road, adjoining the southern boundary of the ICI landholding.

3.2 Other than for public transport vehicles and any connection to an Easter Compton By-Pass there will be no connection between the development areas east of the M49 and the B4055 Easter Compton to Pilning Road. It is anticipated that these areas will be served from a distributor road west of the M49 (the East/West Link) and by way of a further distributor road crossing the M49, inter alia, via the Edsleigh Farm overbridge.

4

Ecological Corridors

4.1 The ecological corridors to be maintained shall be those shown on the Plan, namely Vimpenny's Lane the Estuary "Buffer Zone" the Semi Improved Grass Land south of the A403 the un-named green lane linking Gypsies Platt with the boundary of the Zeneca Avlon Works and (as may be rerouted and modified) Middle Compton Rhine Upper Compton Rhine and Impool Rhine.

4.2 The area to be safeguarded from development within these corridors shall not be required to extend to more than 20 metres either side of the centreline of the feature defined.

4.3 The distributor roads to service development east and west of the M49 may cross these corridors subject to appropriate measures (to be agreed between the Owner and the Council or determined via the
Dispute Resolution Procedure) being taken to mitigate any material adverse impact upon the function of the corridors as part of a network of wildlife corridors.
SECOND SCHEDULE

Matters to be addressed by and agreed principles for the Ecological and Estate Management Plan ("the EEM Plan")

1 The Plan shall address five main areas:-

1.1 Retention and (through the long-term operation of the EEM Plan) enhancement of principal landscape features and ecological corridors within the Overall Masterplan Area;

1.2 Retention and (through the long-term operation of the EEM Plan) enhancement of the wild life value (pending development) of existing agricultural areas within the Overall Masterplan Area;

1.3 Monitoring of ecological mitigation measures associated with the Development; and

1.4 Landscape and ecological principles for creation of new habitats and advanced landscape planting as part of the Development.

1.5 Principles procedures and controls in relation to inspection laying maintenance repair and renewal of services and service media serving or to serve the Development insofar as they pass or are to pass under over or through the areas to which the EEM Plan relates

2 The part of the EEM Plan referred to at paragraph 1.1 above will address (inter alia) the buffer zone for the Severn Estuary SSSI and wader feeding areas greenways and major rhines to be retained following development and the proposed Ecological Refuge Area.

3 The part of the EEM Plan referred to at paragraph 1.2 above will address (inter alia) measures which tenant farmers will be encouraged to adopt to increase biodiversity such as sympathetic
hedge and rhine maintenance, appropriate field management regimes
and the creation of field headlands; and proposals for encouraging
adoption of the relevant measures.

4 The part of the EEM Plan referred to in paragraph 1.3 above shall
address the proposals for mitigation listed in the tables referred
to in paragraph 6.10 of the Environmental Statement which
accompanied the Development Application on pages 82 to 91.

5 The EEM Plan shall in respect of each of the matters referred to
in paragraph 1 above include guidance notes or outline
specifications addressing (as appropriate):

5.1 Techniques and methods to be adopted in managing maintaining
planting or mitigating;

5.2 Timetabling of activities;

5.3 Procedures for monitoring the efficacy of measures taken;

5.4 Report and Review procedures;

5.5 Circumstances in which modification of activities procedures or
timetabling may be considered; and

5.6 Those responsible for overseeing implementation.
THIRD SCHEDULE

Part I
Roads to be used by construction traffic

M49
A403

Part II
Roads to be avoided by construction traffic

B4055
Severn Road
Lawrence Weston Road
EXECUTED under the
COMMON SEAL of
IMPERIAL CHEMICAL
INDUSTRIES PLC
in the presence of: 

Director

[Signature]

ASSISTANT
SECRETARY

K. W. SMITH

- 45 -
Key
- Study Area
- HSE Consultation Zones
- DPZ
- Inner

Bristol City and South Gloucestershire Councils
Avonmouth and Severnside Study
HSE COMAH Inner Zones

WYG Planning & Design
part of the WYG group

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A066776 10.mxd

January 2012
Avonmouth and Severnside Study

HSE COMAH Zones
(All Zones)
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<th>HSE Site Ref</th>
<th>Site Type</th>
<th>Grid Ref</th>
<th>Site Address</th>
<th>Approved</th>
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<td>10/08/10 Sep-10</td>
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Enquiry Ref: BRISTOL GENERAL - 111165/AJB/MC

Your Ref:

Date: 18 February 2011

For the attention of Mr Andrew Strange

WYG - White Young Green
Ropemaker Court
12 Lower Park Row
Bristol
Avon
BS1 5BN

Dear Sir/Madam

GOVERNMENT PIPELINES AND STORAGE SYSTEM
A066776 - LS-110216-UX-516-TDF

Thank you for your letter dated 16/02/2011 09:25:00

We can confirm that our client's apparatus, the Government Pipelines and Storage System (GPSS), may be affected by your proposals as indicated on the attached plan(s). The plan(s) supplied are intended for general guidance only and should not be relied upon for excavation or construction purposes. No guarantee is given regarding the accuracy of the information provided and in order to verify the accurate location of the pipeline in conjunction with your proposals you should contact OPA Central Services, to arrange a site visit. Their contact details are given be ow.

OPA Central Services
Ashdon Road
Saffron Walden
Essex
CB10 2NF
Tel: 01799 564101

When contacting OPA Central Services, please quote the Enquiry Ref given at the top of this letter, which is specific to this enquiry. Please note that you should contact OPA Central Services within 28 days of the date of this letter in order to validate this enquiry otherwise it will become void.

You should note that the interests of the GPSS are conserved by means of the Land Powers (Defence) Act 1958, in particular Section 16 of the Act, and other legislation such as the Pipeline Safety Regulations 1996. It is, however, the Land Powers (Defence) Act 1958 that specifically prohibits any development and most intrusive activities within a GPSS Wayleave without specific consent from the Secretary of State for Defence. GPSS Wayleaves are generally 6 metres wide and besride the pipeline 3 metres on either side and can incorporate other associated GPSS facilities.

OPA Central Services will be able to provide guidance on the required procedures for entering into a Section 16 Consent and provide confirmation on permitted development and intrusive activities. The whole process of obtaining Section 16 Consent can take between four and six weeks depending on circumstances at the time of application.

To reiterate, you should not undertake any work or activity without first contacting the GPSS Operator for advice and, if required, Section 16 Consent.
For your additional information please visit www.linesearch.org, subheading useful information, standard requirements for working/crossing Government pipelines.

You should also be aware that landowners and third parties have a duty of care not to carry out any works that have the potential to damage GPSS apparatus. This duty of care applies even if the works themselves are situated more than 3 metres from the pipeline. Examples of such works are mineral extraction, mining, explosives, piling and windfarms.

Please note that implementation of any unapproved work that affects a GPSS Wayleave may result in serious consequences in terms of health and safety, expense and other attendant liabilities. In such cases it is the perpetrator of the act, together with any other promoting organisation, that shall be held fully accountable for any resulting damage.

Should you require any further assistance regarding this letter please contact the undersigned or alternatively, you can contact the OPA Central Services using the details provided above.

Yours faithfully

[Signature]

FISHER GERMAN LLP (GPSS LAND AGENT)

Enc Location Plan
Special Requirements Booklet

CC OPA Central Services
Information for OPA Central Services
Third Party Contact Details:
07900 570254

18 February 2011
Please note that my linesearch reference is LS-110216-UX-516-TDF

Regards

Andrew Strange
Regional Director

Tel: +44 (0)117 9254393
Sir/Madam

We are undertaking an infrastructure study for the Avonmouth/Severnside area on behalf of the South West RDA, Bristol City and South Gloucestershire Councils. I attach a plan that shows the extent of the study area.

Please could you confirm whether any of the pipelines for which you are responsible lie within this area and, if they do, forward a plan to show their location?

Thanks.

Andrew Strange
Regional Director

WYG PLANNING & DESIGN
Ropemaker Court, 12 Lower Park Row, Bristol, BS1 5BN
Tel: +44 (0)117 9254393
Fax: +44 (0)117 9254239
Mob: +44(0)7900570254

www.wyg.com

Winner Institution of Civil Engineers Award 2010
Winner BREEAM (BRE Environmental Assessment Method) Award 2010
Winner Royal Institute of British Architects Award 2010
Winner NCE/ACE Consultants of the Year 2009 'Outstanding Contribution Award'
Winner RoSPA Occupational Health and Safety Gold Medal Award 2009
Winner British Expertise Awards 2009

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FOR FURTHER DETAILS PLEASE CONTACT
FISHER GERMAN ON 01530 412821
REFERENCE NOS.................................

GPSS LOCATION PLAN
EXTRACT OF PIPELINE BRISTOL LINES

DATE: FEBRUARY 2011
NOT TO SCALE

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Approximate position only Contact Pipeline Operator prior to works.

FISHER GERMAN
CHARTERED SURVEYORS
Fisher German LLP. The Grange
80 Tamworth Road, Ashby de la Zouch,
Leicestershire, LE65 2BW
Fax: (01530) 413896 and Telephone: (01530) 412821

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GPSS LOCATION PLAN
EXTRACT OF PIPELINE RW/BW

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REFERENCE NOS...........

FISHER GERMAN LLP, The Grange
80 Tamworth Road, Asahi de la Zouch,
Leicester, LE65 2BW
Fax: (01530) 413896 and Telephone: (01530) 412821

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EXTRACT OF PIPELINE RW/BW

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DATE: FEBRUARY 2011
NOT TO SCALE
GPSS LOCATION PLAN
EXTRACT OF PIPELINE H/A(6)

DATE: FEBRUARY 2011
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prior to works.

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OPERATOR BEFORE ANY EXCAVATION OR
CONSTRUCTION WORK COMMENCES.

FOR FURTHER DETAILS PLEASE CONTACT
FISHER GERMAN ON 01530 412821
REFERENCE NOS..........................

FISHER GERMAN LLP. The Grange
80 Tamworth Road, Ashby de la Zouch,
Leicestershire, LE65 2BW
Fax:(01530) 413896 and Telephone:(01530) 412821

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GPSS LOCATION PLAN
EXTRACT OF PIPELINE H/A(6) & B/A

DATE: FEBRUARY 2011
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Approximate position only
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WARNING
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FOR FURTHER DETAILS PLEASE CONTACT FISHER GERMAN ON 01530 412821
REFERENCE NOS. .............................................

GPSS LOCATION PLAN
EXTRACT OF PIPELINE H/A(6), B/A & C/B

DATE: FEBRUARY 2011
NOT TO SCALE

Approximate position only Contact Pipeline Operator prior to works.

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FISHER GERMAN
CHARTERED SURVEYORS

DATE: FEBRUARY 2011
NOT TO SCALE
WARNING
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FOR FURTHER DETAILS PLEASE CONTACT FISHER GERMAN ON 01530 412821

REFERENCE NOS.

GPSS LOCATION PLAN
EXTRACT OF PIPELINE N/S(S)

DATE: FEBRUARY 2011
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N

Approximate position only Contact Pipeline Operator prior to works.

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The following environmental constraints do not occur:

- World Heritage Sites
- Heritage Coasts
- Scheduled Monument
- National Nature Reserves

Key

Environmental Constraints
- Area of Outstanding Natural Beauty
- Ramsar Site
- Special Area of Conservation
- Special Protection Areas
- Site of Special Scientific Interest
- Site of Special Scientific Interest (Ditches & Rhynes)
- National Nature Reserves
- Scheduled Monument
- Registered Parks and Gardens
- Registered Battlefields
- Historic Buildings (Listed I, II*, A & B)
- Conservation Areas
- Woodland
- Housing and Open Space Allocation
- Airport/Artfield
- Public Safety Zones
- Mineral Reserves
- Mineral Consultation Zone
- RSS Strategic Housing Allocation

Existing Infrastructure
- Existing Substation
- Existing Cable Sealing End Compound
- Existing 400kV Overhead Line
- Existing 275kV Overhead Line
- Existing 132kV Overhead Line
- WPD 132kV Overhead Line to be removed

Proposed Infrastructure
- Preferred Route Corridor

This map includes data from the following sources:

- National Grid
- English Heritage
- Forestry Commission - © Crown Copyright. All rights reserved [2011]
- This report is based on Cadw Historic Assets Data. © Crown copyright. Cadw
- © Crown copyright. All rights reserved. Countryside Council for Wales, 100018813 [2011]
- Registered Battlefields
- Scheduled Monument
- RSS Strategic Housing Allocation

The following environmental constraints do not occur:

- World Heritage Sites
- National Parks
- Heritage Coasts
- Protected Wrecks
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Key

Existing Infrastructure
- Existing Substation
- Existing 400kV Overhead Line
- Existing 275kV Overhead Line
- Existing 132kV Overhead Line
- Administrative Boundary

Route Corridor 1
Route Corridor 2

Environmental Constraints
- Area of Outstanding Natural Beauty
- Ramsar Site
- Special Area of Conservation
- Site of Special Scientific Interest
- Site of Special Scientific Interest (Ditches & Rhynes)
- National Nature Reserves
- Scheduled Monument
- Registered Parks and Gardens
- Registered Battlefields
- Historic Buildings (Listed 1*, 1**, A & B)

- Conservation Areas
- Woodland
- Settlement
- Housing and Public Open Space Allocation in Development Plan
- RSS Strategic Housing Allocations
- Airport/Airfield
- Public Safety Zones
- Mineral Consultation Zone
- Mineral Reserves

NOTE 1:
The following environmental constraints considered in routeing do not occur in the study area:
- National Parks
- Heritage Coasts

NOTE 4:
The following environmental constraints considered in routeing do not occur in the study area:
- National Parks
- Heritage Coasts

FOR PUBLIC CONSULTATION

Project: Hinkley C Connections
Title: Route Corridors Inset 3
Figure: 5c
Drawing No:
Date: 28-08-09
TEP Ref No: G1979.051e

Drawn: CM
Checked: CC
Approved: CC
### 3.2 Stage 2 - Habitat Assessment

The following table presents the findings of the habitat-based assessment of the study area, in relation to: (a) its (likely) suitability for supporting substantial concentrations of over-wintering wildfowl and waders; and (b) its characteristics as existing wetland habitat (or potential for wetland habitat creation and/or enhancement). See Figure 1 for corresponding site locations.

<table>
<thead>
<tr>
<th>Description of terrestrial habitats</th>
<th>Description of aquatic habitats</th>
<th>Bird survey findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Existing land use</strong></td>
<td><strong>Topography</strong></td>
<td><strong>Stage 2 - Habitat Assessment</strong></td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td><strong>Substrate/vegetation cover</strong></td>
<td><strong>Connectivity with other potentially suitable sites (see Figure 1)</strong></td>
</tr>
<tr>
<td><strong>Ground softness</strong></td>
<td><strong>Sightline distance(s)</strong></td>
<td><strong>Description of boundary features</strong></td>
</tr>
<tr>
<td><strong>Description of adjacent areas</strong></td>
<td><strong>Standing water features</strong></td>
<td><strong>Ditch/rhyne characteristics</strong></td>
</tr>
<tr>
<td><strong>Presence of field drainage outfalls</strong></td>
<td><strong>Waterfowl presence (numbers, species, behaviour, etc)</strong></td>
<td><strong>Suitability for overwintering waterfowl</strong></td>
</tr>
<tr>
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<td><strong>Ditch/rhyne characteristics</strong></td>
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<td></td>
</tr>
<tr>
<td><strong>Suitability for overwintering waterfowl</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **A Commercial car storage area**  | **Flat**                       | **Concrete hardstanding (100%)** |
| **Flat**                           | **Concrete hardstanding (100%)** |
| **N/a**                            | **Yes - Disused Reservoir Pools** |
| **Up to 100m**                     | **Security fencing with landscape planting** |
| **Predominantly industrial setting; however, Adjacent to Disused Reservoir Pools** | **None** |
| **N/a**                            | **N/a** |
| **N/a**                            | **None** |
| **None**                           |                      |
| **Potentially suitable (but sub-optimal) habitat for roosting lapwing/golden plover (given extent of sightlines and flat topography)** |                      |

| **B Derelict industrial/commercial** | **Flat**                       | **Concrete hardstanding (100%)** |
| **Flat**                           | **Concrete hardstanding (100%)** |
| **N/a**                            | **Yes - Salt Rhyne Balancing Pond and Hallen Marsh (Area E)** |
| **Up to 100m**                     | **Security fencing with landscape planting** |
| **Predominantly industrial setting; however, Salt Rhyne Balancing Pond and Hallen Marsh (Area E) located adjacent to the site** | **None** |
| **N/a**                            | **N/a** |
| **N/a**                            | **None** |
| **None**                           |                      |
| **Predominantly industrial/commercial setting; however, Avonmouth Pools (Area D) in close proximity.** |                      |

| **C Greenfield – mosaic of grazing pasture and unmanaged grassland** | **Flat**                       | **Predominantly grassland/rushes of varying heights (90-100%), the majority <5-10cm in height, with some taller areas (up to 50cm)** |
| **Flat**                           | **Predominantly grassland/rushes of varying heights (90-100%), the majority <5-10cm in height, with some taller areas (up to 50cm)** |
| **Soft in places (penetration of ground by 6” nail).** | **Located in close proximity to Avonmouth Pools (Area D)** |
| **Up to 200m in most cases**       | **Boundaries largely comprise mature hedgerows (up to 5m high) and tree-lines (up to 10m high)** |
| **Predominantly industrial/commercial setting; however, Avonmouth Pools (Area D) in close proximity.** | **Small (<5m wide), isolated areas of standing water scattered throughout the site** |
| **Majority of ditches ~1.5-2.0m deep, with ~0.5-0.8m water depth. No obvious signs of flow, but good levels of connectivity** | **-** |
| **2 x mallard within ditch network** |                      |
| **Ditch network likely to support wildfowl (e.g. mallard & teal), with snipe likely to be present in areas of tussocky grassland. Closely grazed areas potentially suitable for use by roosting/foraging lapwing and curlew.** |                      |

<p>| <strong>D Avonmouth Sewage Works and Pools</strong> | <strong>Flat</strong>                       | <strong>Sewage works – predominantly concrete hardstanding with relatively small areas of grassland</strong> |
| <strong>Flat</strong>                           | <strong>Sewage works – predominantly concrete hardstanding with relatively small areas of grassland</strong> |
| <strong>N/a</strong>                            | <strong>Yes – located adjacent to Area C</strong> |
| <strong>&lt;50m</strong>                           | <strong>Security fencing with mature hedgerows and scrub (up to 5m high) and</strong> |
| <strong>Predominantly industrial/commercial setting to the north &amp; east; however, greenfield land (Area C) to the south and west.</strong> | <strong>Concrete pools associated with operational works</strong> |
| <strong>N/a</strong>                            | <strong>N/a</strong> |
| <strong>N/a</strong>                            | <strong>None</strong> |
| <strong>None</strong>                           |                      |
| <strong>None of the remaining habitats within the operational sewage works site appear to provide potentially suitable habitat for over-wintering waterfowl.</strong> |                      |</p>
<table>
<thead>
<tr>
<th>Existing land use</th>
<th>Topography</th>
<th>Substrate/vegetation cover</th>
<th>Ground softness</th>
<th>Connectivity with other potentially suitable sites (see Figure 1)</th>
<th>Sightline distance(s)</th>
<th>Description of adjacent areas</th>
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<th>Waterfowl presence (numbers, species, behaviour, etc)</th>
<th>Suitability for overwintering waterfowl</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>Agricultural land (arable and pasture)</td>
<td>Pasture – generally flat with ridge and furrow. Arable - flat</td>
<td>Soft in places (penetration of ground by 6’’ nail).</td>
<td>Yes – Located adjacent to Salt Rhyne Balancing Pool and Crook’s Marsh (Area L &amp; K).</td>
<td>Up to 200m in some arable areas</td>
<td>Boundaries largely comprise mature hedgerows and tree-lines, mainly 2-5m in height (but up &gt;5m in some cases)</td>
<td>Predominantly industrial/commercial setting to the south and west; however, more extensive area of grazing pasture to the north (Crook’s Marsh (Area L) and east. Avonmouth Railway Line and M49 motorway corridor also located adjacent to the site.</td>
<td>Small number of isolated waterbodies (&lt;10m diameter) scattered throughout the site.</td>
<td>Small numbers (fewer than five) of mallard, coot and teal. Avonmouth Pools represent good quality habitat for over-wintering waterfowl (particularly wildfowl) (see Cresswell Associates, 2010 for further details).</td>
</tr>
<tr>
<td>F</td>
<td>Horse-grazed pasture</td>
<td>Minor undulations in topography (~0.2-0.4m)</td>
<td>Grassland (vast majority &lt;2cm in height) with isolated stands of bramble scrub (up to 1.5m in height).</td>
<td>No – however, Orchard Pools and the foreshore located nearby.</td>
<td>Up to 100m</td>
<td>Boundary features largely comprise mature hedgerows with trees (5-10m high). In several cases, internal boundaries removed and replaced with post and wire fences.</td>
<td>Predominantly residential (Severn Beach) to the north and east. Orchard Pools/Astra Zeneca fields, and the Severn estuary foreshore located in close proximity to the south and west, respectively.</td>
<td>Several small ponds shown on OS map; however, this was not possible to ground truth, due to lack of land access permission.</td>
<td>None</td>
</tr>
</tbody>
</table>

The findings of the Stage 1 desk study have confirmed the site’s usage by curlew (see Cresswell Associates, 2010).
<table>
<thead>
<tr>
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<tr>
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<td><strong>Topography</strong></td>
<td><strong>Substrate/vegetation cover</strong></td>
</tr>
<tr>
<td>G Grazing pasture</td>
<td>Largely flat with some minor undulations in topography (~0.2-0.4m).</td>
<td>Grassland (vast majority &lt;5cm in height) with isolated areas of scattered rushes (up to 30m in height).</td>
</tr>
<tr>
<td>H Grazing pasture</td>
<td>Largely flat with some minor undulations in topography (~0.2-0.4m).</td>
<td>Grassland (vast majority &lt;5cm in height) with isolated areas of scattered rushes (up to 30m in height).</td>
</tr>
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<tr>
<td><strong>Existing land use</strong></td>
<td><strong>Topography</strong></td>
<td><strong>Substrate/vegetation cover</strong></td>
</tr>
<tr>
<td>I Horse-grazed pasture</td>
<td>Flat</td>
<td>Grassland (vast majority &lt;5cm in height). Pre-construction hedgerow/tree clearance works recently completed at the time of the survey</td>
</tr>
<tr>
<td>J Horse-grazed pasture</td>
<td>Generally flat with ridge and furrow (~0.2-0.3m) present across the majority of fields. In addition, there is an area of raised ground (up to 10m) in the north-eastern corner.</td>
<td>Predominantly grassland (&lt;5-10cm) with some areas of ruderal herbs/scrub.</td>
</tr>
<tr>
<td>Existing land use</td>
<td>Topography</td>
<td>Substrate/vegetation cover</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>K</td>
<td>Horse-grazed pasture</td>
<td>Generally-flat with ridge and furrow (~0.2-0.3m)</td>
</tr>
<tr>
<td>L</td>
<td>Horse-grazed pasture</td>
<td>Generally-flat with ridge and furrow (~0.2-0.3m)</td>
</tr>
<tr>
<td>M</td>
<td>Derelict brownfield site</td>
<td>Flat</td>
</tr>
</tbody>
</table>
Figure 1: Location of Sites Subject to Habitat Assessment

Key

- Study Area
- Extent of Severn Estuary SAC
- Extent of Severn Estuary SPA and Ramsar Site
- The Severnside / Avonmouth boundary within the study area
- Boundary of Habitat Survey Area
- Site Reference (Cross Refer with Appendix III)

The map shows the extent of the Severn Estuary SPA and Ramsar Site, as well as the boundary of the habitat survey area. The study area is highlighted, along with the Severnside / Avonmouth boundary. The key points A to M are marked for site references, with coordinates provided in Appendix III.
Yes!

www.CentralParkBristol.co.uk

THE ABILITY TO DELIVER
Central Park is a 640 acre warehouse and distribution park development, strategically located within the region and designed to be the South West’s largest distribution park, capable of accommodating units of over 1 million sq ft.

Central Park has the benefit of planning consents which enable immediate distribution development without the need for further detailed applications. In addition the site access road is in place, giving Central Park the ability to deliver new facilities without delay arising from further statutory approvals. This unique position allows for immediate delivery of buildings.

Greenfield Site? - Yes!
Whilst most of Avonmouth and Severnside has a long established heavy industrial history, Central Park provides uncontaminated development land.

Planning Consents? - Yes!
Central Park benefits from planning permissions granted in 1957 and 1958, which are valid for specific uses without the need for further applications - these uses include offices (B1a), storage & distribution (B8) and chemical factories (B2).

Serviced Plots? - Yes!
Infrastructure is in place with Phase One master planned to provide a range of serviced sites up to 129 acres. This will provide up to 1.6 million sq ft of logistic accommodation in a range of building sizes to suit individual requirements. Phase Two will provide further sites of up to 112 acres capable of delivering units of over 1 million sq ft with infrastructure to be in place by March 2011.

Capable Developer? - Yes!
Goodman is one of the world’s largest owners and developers of industrial and logistics property. Goodman has £11bn of assets under management worldwide and has developed over 8m sq ft of logistics accommodation in the UK alone in the last 5 years for key occupiers including Constellation, Tesco, Amazon, DHL and Wincanton. [www.goodman.com](http://www.goodman.com)
Join the success story at Western Approach which has been endorsed by such occupiers as Next, Royal Mail, Tesco, DSGI, GKN, Constellation and Warburtons.

OUR DOCKS ARE ONLY 2 MILES APART

The Docks of Avonmouth and Royal Portbury are located within 8 miles of Central Park and form the nearest main UK port in road miles to the Midlands conurbation. The Bristol Port Company’s plans for the development of a £500m deep sea terminal at Avonmouth have been approved by the Government. This project will double the capacity of the Docks over the next ten years.
RAIL CONNECTIONS TO THE DOOR

Central Park benefits from existing rail connections and can accommodate the development of units with direct rail links. In addition there is an open access rail terminal at Bristol Port, Avonmouth with sea container handling facilities. In terms of passenger rail, Bristol is served by two intercity stations - Parkway and Temple Meads - with London reached in 1 hour 30 minutes.

MOTORWAY NET THAT WORKS

Located between the M48 (J1) and M5 (J18) motorways, Central Park offers unrestricted all route access to the motorway network. The scheme also offers plots with extensive frontage to the M49.

Access to the motorway network is north via the A403 Severn Road to Junction 1 of the M48 or south to Junction 18 of the M5 at Avonmouth.
Central Park
WESTERN APPROACH

This Masterplan is indicative only, to show how a variety of building sizes can be arranged. Bespoke design and build packages to suit individual requirements are available. Remember, the answer is - Yes!

PHASE TWO

UNIT 8

Warehouse: 1,248,624 sq ft (116,000 sq m)
Offices (2 storey): 62,431 sq ft (5,800 sq m)
Gatehouse: 300 sq ft (28 sq m)
Total: 1,311,355 sq ft (121,828 sq m)

Plot Area: 63.31 acres (25.62 ha)

UNIT 7

Warehouse: 419,800 sq ft (39,000 sq m)
Offices (2 storey): 21,000 sq ft (1,951 sq m)
Gatehouse: 300 sq ft (28 sq m)
Total: 441,100 sq ft (40,979 sq m)

Plot Area: 25.45 acres (10.30 ha)

UNIT 6

Warehouse: 387,500 sq ft (36,000 sq m)
Offices (2 storey): 19,400 sq ft (1,802 sq m)
Gatehouse: 300 sq ft (28 sq m)
Total: 407,200 sq ft (37,830 sq m)

Plot Area: 23.67 acres (9.58 ha)
**UNIT 5**
- Warehouse: 500,400 sq ft (46,489 sq m)
- Offices (2 storeys): 25,000 sq ft (2,323 sq m)
- Gatehouse: 300 sq ft (28 sq m)
- Total: 525,700 sq ft (48,840 sq m)
- Plot Area: 34.55 acres (13.98 ha)

**UNIT 3**
- Warehouse: 341,700 sq ft (31,745 sq m)
- Offices (2 storeys): 17,100 sq ft (1,589 sq m)
- Gatehouse: 300 sq ft (28 sq m)
- Total: 359,100 sq ft (33,362 sq m)
- Plot Area: 25.48 acres (10.31 ha)

**UNIT 4**
- Warehouse: 378,000 sq ft (35,117 sq m)
- Offices (2 storeys): 18,900 sq ft (1,756 sq m)
- Gatehouse: 300 sq ft (28 sq m)
- Total: 397,200 sq ft (36,001 sq m)
- Plot Area: 22.66 acres (9.17 ha)

**UNIT 2**
- Warehouse: 193,100 sq ft (17,940 sq m)
- Offices (2 storeys): 9,700 sq ft (901 sq m)
- Gatehouse: 300 sq ft (28 sq m)
- Total: 203,100 sq ft (18,869 sq m)
- Plot Area: 14.08 acres (5.70 ha)

**UNIT 1**
- Warehouse: 122,700 sq ft (11,399 sq m)
- Offices: 6,200 sq ft (576 sq m)
- Total: 128,900 sq ft (11,975 sq m)
- Plot Area: 7.83 acres (3.17 ha)

**INDICATIVE MASTERPLAN**

All areas subject to final measurement.
Terms
Design & Build packages are available on either a freehold or leasehold basis. Please contact the agents to discuss your specific requirements.

Central Park

Bristol and South West
Bristol is the economic hub of the south west region with excellent labour availability, education resources, and connectivity. Outside of London, the West of England has the largest proportion of highly qualified workers in the UK and can draw on a wide labour pool including South Wales. As a place to live and work, it is unrivalled.

SatNav: BS35 4GG

A development by in association with
SEVERNSIDE DISTRIBUTION LAND LIMITED

Charles Binks/Russell Crofts
Paul Hobbs/Nick Collins

www.CentralParkBristol.co.uk

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2. Photos etc: The photographs show only certain parts of the property as they appeared at the time they were taken. Areas, measurements and distances given are approximate only.

3. Regulations etc: Any reference to alterations to, or use of, any part of the property does not mean that any necessary planning, building regulations or other consent has been obtained. A buyer or lessee must find out by inspection or in other ways that these matters have been properly dealt with and that all information is correct.

4. VAT: The VAT position relating to the property may change without notice. January 2011

Exeter
Plymouth
& South West

Birmingham
Midlands
& The North

Avonmouth
DOCKS

SECOND
SEVERN
CROSSING

SEVERN
BRIDGE

Bristol
Parkway

BRISTOL
AIRPORT

M49 - J1 4.5 miles
M5 - J1 6.5 miles
Avonmouth Dock 8 miles
Bristol Parkway 19 miles
Exeter 81 miles
Birmingham 88 miles
Southampton 107 miles
Heathrow 108 miles
London 125 miles
Manchester 175 miles

Avonmouth Divocks

Bristol
DOCKS

SECOND
SEVERN
CROSSING

Thames

SEVERN
BRIDGE

Bristol
Parkway

BRISTOL
AIRPORT

M49 - J1 4.5 miles
M5 - J1 6.5 miles
Avonmouth Dock 6 miles
Bristol Parkway 8 miles
Royal Portbury Dock 9 miles
Bristol Int Airport 7 miles
Exeter 81 miles
Birmingham 88 miles
Southampton 107 miles
Heathrow 108 miles
London 125 miles
Manchester 175 miles

Mileage distances (from BS35 4GG) - Source: Google Maps

M48 - J1 4.5 miles
M5 - J1 6.5 miles
Avonmouth Dock 6 miles
Bristol Parkway 8 miles
Royal Portbury Dock 9 miles
Bristol Int Airport 7 miles
Exeter 81 miles
Birmingham 88 miles
Southampton 107 miles
Heathrow 108 miles
London 125 miles
Manchester 175 miles

Central Park logo update - 5088.indd   8Central Park logo update - 5088.indd   8 6/1/11   12:29:38
Study Area
Flood Zone 3a
Flood Zone 3b (Functional Floodplain)
Flood Zone 2
Our Proposals

Environmental and heritage issues

- The heritage features behind the defences will have a consistent standard of protection, with the likelihood of flooding in any given year being less than 1 in 200.
- In Avonmouth Dock there is a large area which is internationally important nature conservation site.

Proposed improvements after 2060

- The railway line will provide an adequate defence until 2060. If the railway has not been raised by that date, we will construct a secondary defence line behind the railway. This will ensure the chance of tidal flooding to buildings is maintained at or less than 1 in 200 in any year.
- At Severn Beach, drainage improvements may be required to cope with any increased wave over-topping.

Improvements to defences before 2030

- We expect the majority of flood defence improvements to be funded by new building developments under their planning obligations.
- The programme for improvement will be greatly influenced by business investment.
- Between the Severn Crossings we will undertake phased raising of the embankments by up to 1m to keep pace with climate change. This will ensure the chance of tidal flooding is retained at or less than 1 in 200 in any year.
- At Severn Beach, there are wave walls and concrete surfacing. Further south the railway embankment and dock defences reduce flood risk.
- The chance of tidal flooding in the vicinity of the docks is a 1 in 20 chance in any year.

Improvements to defences after 2030

- Saltmarsh in front of the earth embankments near Aust provides protection from wave action and erosion. Together these provide protection against tidal flooding with a 1 in 100 chance in any year.
- International important nature conservation site.
- For the existing flood defences, we expect the chance of tidal flooding in any given year to remain at or less than 1 in 200.
- Saltmarsh in front of the earth embankments near Aust provides protection from wave action and erosion. Together these provide protection against tidal flooding with a 1 in 100 chance in any year.
- International important nature conservation site.
- For the existing flood defences, we expect the chance of tidal flooding in any given year to remain at or less than 1 in 200.
Schedule of land uses

<table>
<thead>
<tr>
<th>Parcel</th>
<th>Type</th>
<th>Area (Hectares)</th>
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<tr>
<td>BP1</td>
<td>Bristol Port and Related uses</td>
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<td>M2</td>
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<td>M3</td>
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<tr>
<td>OS1</td>
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</tr>
<tr>
<td>OS2</td>
<td>Open Storage</td>
<td>3.9</td>
</tr>
</tbody>
</table>

Key
- Study Area
- Bristol Port and Related Uses (235.4 ha)
- Mixed B1/B2/B8/Sui Generis Developments (518.6 ha)
- Open Storage (41.9 ha)
- Infrastructure Sites
Figure 7.6 – Breach Hazard Bandwidth (Figure 7.12 from Technical Report)
### Schedule of redevelopment of previously developed land

<table>
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<tr>
<th>Parcel</th>
<th>Area (Hectares)</th>
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</thead>
<tbody>
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<tr>
<td>2P</td>
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<td>0.6</td>
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<tr>
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</tr>
<tr>
<td>11P</td>
<td>8.6</td>
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</table>

### Schedule of development of Greenfield Land

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<th>Area (Hectares)</th>
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</table>

#### Study Area
- Redevelopment of previously developed land (39.6 ha)
- Development of greenfield land (120 ha)