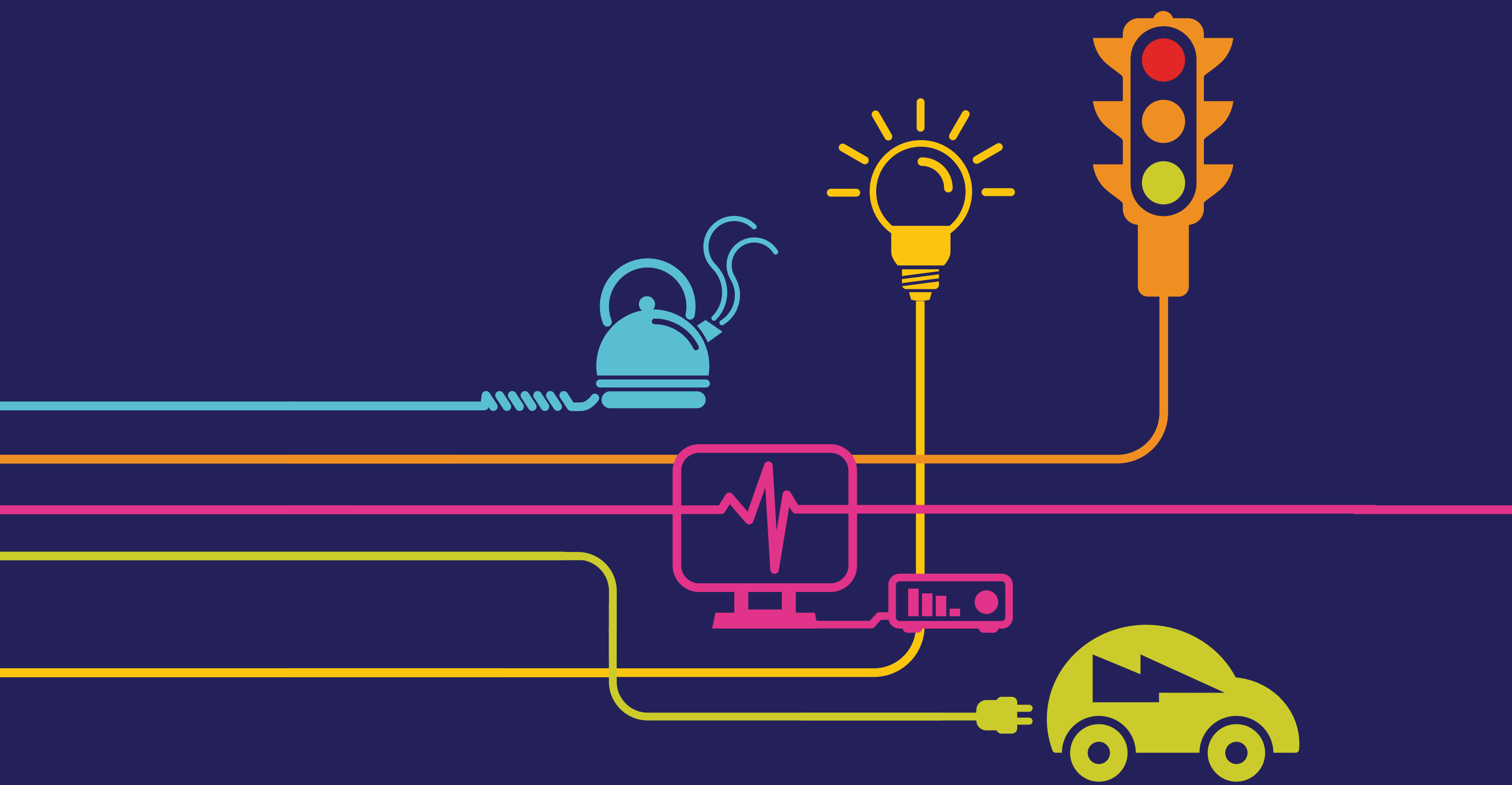
Document 5.23.4

nationalgrid

Environmental Statement
Flood Risk Assessment
Seabank Substation

Hinkley Point C Connection Project

Regulation 5(2)(e) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009



Application Reference EN020001

May 2014

Hinkley Point C Connection Project

MAY 2014

VOLUME 5.23.4, SEABANK SUBSTATION FLOOD RISK ASSESSMENT

Document Control			
Document Properties			
Organisation	**National Grid**		
Author	**Soon Hock Lee, Iain Blackwell**		
Approved By	**Andy Debney**		
Title	**Seabank Substation Flood Risk Assessment**		
Document Reference	**Volume 5.23.4**		
Date	**Version**	**Status**	**Description/Changes**
09/05/14	A	Live	Final version for DCO submission

Table of Contents

INSETS (VOLUME 5.23.4.1)

APPENDICES (VOLUME 5.23.4.2)

EX1. EXECUTIVE SUMMARY

EX1.1.1 This Flood Risk Assessment (FRA) accompanies National Grid Electricity Transmission Limited's (National Grid) application for development consent to construct, operate and maintain a new 400,000 volt (400kV) connection between Bridgwater, Somerset and Seabank Substation, north of Avonmouth ("the Proposed Development"). As part of the Proposed Development, an extension is proposed to the existing Seabank Substation.

EX1.1.2 This FRA complies with the requirements set out in National Policy Statements published by the Department for Energy and Climate Change (July 2011), specifically Overarching Energy Policy (EN-1) and Electricity Networks Infrastructure Policy (EN-5). It also complies with the Planning Practice Guidance (PPG) on Flood Risk and Coastal Change which came into effect in March 2014 and the National Planning Policy Framework (March 2012) to which this PPG refers.

EX1.1.3 Seabank Substation, including the proposed extension area, lies in an area designated by the Environment Agency as Flood Zone 3. This means that the site has a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

EX1.1.4 The NPPF sets out a Sequential Test, which states that preference should be given to development located within Flood Zone 1. If there is no reasonably available site in Flood Zone 1, then built development can be located in Flood Zone 2. If there is no reasonably available site in Flood Zone 1 or 2, then nationally significant energy infrastructure projects such as the Hinkley Point C Connection project - classified as "Essential Infrastructure" - can be located in Flood Zone 3 subject to passing a series of tests known as the Exception Test.

EX1.1.5 **Volume 5.2.1** describes the alternatives considered for the Proposed Development, including options for the route and method of connection (overhead line or underground cable). This demonstrates compliance with the principle of the Sequential Approach. For the preferred strategic option of an on land connection between Bridgwater and Seabank, there is a need to connect the proposed new 400kV connection to the existing National Grid Seabank 400kV Substation. The Sequential and Exception Tests are applied within the constraints of the preferred route and connection option.

EX1.1.6 Given this constraint with regard to existing infrastructure, there are no other suitable sites at lower flood risk available in which to locate the modifications and extensions of the existing Seabank 400kV Substation that will facilitate both the connection of the proposed Seabank 3 power station (adjacent to Seabank 400kV Substation) and the new Hinkley Point C Connection. This FRA provides the evidence base that the requirements of the Sequential Test have been met.

EX1.1.7 With regard to the Exception Test, it has been demonstrated that:

- the proposed extension to the existing substation would provide wider sustainability benefits to the community that outweigh the flood risk, which has been assessed in the context of the Local Planning Authority's Strategic Flood Risk Assessment; and

- the substation, once modified, would be safe for its lifetime taking account of the vulnerability of its users, and would not increase flood risk elsewhere.

EX1.1.8 Whilst there is a flood risk to the site, the details included in this FRA demonstrate that the requirements of the Exception Test have been met.

EX1.1.9 This FRA has concluded that:

- There is a flood risk in the event of extreme tidal flood events, even with the presence of the existing flood defences along the Severn Estuary, due to the low lying nature of the site. The tidal flood risk, even under the current 'defended' situation (with the Severn Estuary tidal flood banks in place) is assessed as high with modelled flood depths at the site of up to 0.25m during the 1 in 200 (0.5%) annual probability event due to overtopping of the tidal defences. Allowing for climate change, this risk would increase significantly by the end of the lifetime of Seabank Substation based on overtopping and breach modelling undertaken as part of the Strategic Flood Risk Assessment for the area.

- There is a very high risk of flooding from extreme tidal events for the 'undefended' situation i.e. without the existing tidal defences. Various strategies and plans for the area indicate that in the short, medium and long term, flood risk will be managed to maintain the current level of flood risk, to keep pace with the impacts of climate change, primarily due to sea level rise. The economic activity in the area, including major industrial and other commercial activities, depend on the tidal defences being in place. However, continuation of these strategic options and policy approaches cannot be guaranteed as they depend on future funding being available. Seabank Substation on its own would therefore need to be resilient to flooding, taking account of both sea level rise and other factors such as policy changes.

- Flood risk from other sources (fluvial, surface water, groundwater, sewers, reservoirs and other artificial sources) is demonstrated to be low.

- The impact of the development on flood risk elsewhere is demonstrated to be low. There is a minor loss of tidal floodplain storage; however the local increase in water level is demonstrated to be less than 1mm and imperceptible in terms of any change in flood risk elsewhere. There is no increase in runoff volumes discharging to the local rhynes. Minor localised runoff from impermeable surfaces will infiltrate surrounding permeable surfaces and have no significant impact on existing flood risk.

- The estimated levels for the 1 in 200 (0.5%) and 1 in 1,000 (0.1%) annual probability flood events are around 6.65mAOD and 6.90mAOD respectively for the <u>defended</u> situation. With allowance for climate change and a design life of 40 years, the estimated flood levels for the 1 in 200 (0.5%) and 1 in 1,000 (0.1%) annual probability flood events are 7.28mAOD and 7.65mAOD respectively. The minimum proposed finished floor level of approximately 6.60mAOD is well below the 1 in 1,000 (0.1%) annual probability flood event with climate change. There is therefore a need to design the site layout to take account of the flood levels being higher than the ground level, by employing suitable mitigation measures for this flood risk.

- The primary measure proposed at the site to mitigate flood risk is to build a perimeter flood defence wall with flood gates at the entrance (these would normally be closed and only opened for intermittent access if there is no flood risk and it is safe to do so). The minimum proposed defence level of 8.05mAOD is 1.15m above the present 1 in 1000 (0.1%) annual probability event level of 6.90mAOD, and 400mm above the 1 in 1000 (0.1%) annual probability event level of 7.65mAOD at the end of the design life, taking account of sea level rise associated with climate change.

- The proposed operational life of the substation is 40 years although Hinkley Point C Power Station would be likely to generate power for an estimated 60 years. Therefore, consideration is given to operation for a further 20 years. This would give an estimated flood level of approximately 7.90mAOD. The design level for the flood defences at the site at 8.05mAOD is approximately 150mm above this level, and therefore, the site would continue to be protected to 2080. During the operational life of the substation, the required defence level would be reviewed, taking into consideration actual sea level rise and flood risk management strategies in place at that time. This approach is consistent with a managed adaptive response to climate change. The design of the flood defence wall would also allow for a future increase to the height of the wall, consistent with the precautionary principle such that the currently proposed works do not restrict future adaptation measures.

- This mitigation option also provides protection to the existing infrastructure at Seabank Substation, thereby building resilience for the entire substation site, which also connects to both the Seabank power station and the adjacent Western Power Distribution 132kV substation.

- National Grid's Flood Mitigation Policy is to protect up to the 1 in 1,000 (0.1%) annual probability event where possible. For this Seabank site, this level would be 6.90mAOD in 2014, rising to 7.65mAOD after around 40 years operation, with the existing flood defences along the Severn Estuary remaining in place i.e. the defended situation. The wider flood risk policies affecting the area suggest that in the short, medium and long term, flood risk will continue to be managed to maintain the current level of risk although continued implementation of these policies cannot be relied upon over the full lifetime of Seabank Substation. However, if the existing tidal defences on the Severn Estuary defences were severely impacted due to a lack of maintenance (for example, due to policy changes) a vast area from Avonmouth 3km to the south of Seabank, stretching several kilometres to the north, would become at considerably higher risk of flooding. It is therefore considered over conservative in this instance to design for a 1 in 1,000 (0.1%) annual probability event for the undefended situation.

- The measures proposed to address tidal flood risk at the site are also appropriate for other forms of flooding, although flood risk from other sources is significantly lower. The site currently has a drainage sump and pumping arrangement to deal with surface water at the site. This arrangement will continue and it is anticipated that this could deal with the potential surface water runoff trapped within the site compound following the construction of the perimeter flood defence wall, and with flood gates at the access point closed.

- The impact of climate change has been assessed using the latest UKCP09 projections. This covers the anticipated operational life of the substation to 2060, with measures proposed to take into account the impacts of climate change. In the event that the site is still required beyond 2060, there is additional adaptive capacity to address the potential future impacts of increased sea level rise, fluvial flows and rainfall intensity. Under the sensitivity testing to the H++ climate change scenario, the flood defences proposed for the site would allow the substation to remain operational during the 1 in 1,000 (0.1%) annual probability event in 2060.

- A safe access and egress plan should be included within the management plan to ensure that suitable arrangements are allowed for in the event of a flood which might affect area in the vicinity of the site. However, as the substation is an unmanned site it would be unusual for there to be any planned maintenance activities during a flood event. With the flood defence wall around the site and the flood gates kept in the closed position, the substation would operate effectively during flood events and therefore no access during flood events would be necessary.

- The site lies within an area designated to receive a Flood Warning in the event that a flood is likely to occur. For escape and evacuation, should any personnel be on site, it is recommended that the substation is signed up to the Floodline Warnings Direct Service provided by the Environment Agency so that adequate action could be taken to evacuate the site if necessary. It should however be noted that the substation site could also be used as a preferred place of refuge in the event that any operations staff are on site during flooding. This is linked primarily to the risk of flooding of access routes to the site, in the event that the site is manned at the onset of a flood event, and routes away from the site are impassable.

1. INTRODUCTION

1.1 Background and Context for the Flood Risk Assessment

1.1.1 In September 2007, National Grid received an application for the connection of a new nuclear power station at Hinkley Point, Somerset (Hinkley Point C Power Station) to the high voltage electricity transmission system. This connection, in combination with others in the South West and South Wales and Gloucestershire, triggered the need for new transmission capacity in the region.

1.1.2 A detailed explanation of the need for the Proposed Development is contained in National Grid document 'Need Case for the South West and South Wales and Gloucestershire Regions' (2014) (Ref 1.1).

1.1.3 As part of the application for development consent, a Flood Risk Assessment (FRA) is required. This should demonstrate that flood risk from all sources has been considered, and that a series of criteria are met, referred to as the Sequential Test and the Exception Test. These criteria are considered in detail within section 3 of this FRA.

1.1.4 This FRA accompanies National Grid Electricity Transmission Limited's (National Grid) application for development consent to construct, operate and maintain a new 400,000 volt (400kV) connection between Bridgwater, Somerset and Seabank Substation, north of Avonmouth ("the Proposed Development"). As part of the Proposed Development, there is a need for modifications and extensions to the existing Seabank 400kV Substation, which will also facilitate the connection of other new generation such as Seabank 3, located immediately north of Seabank Substation.

1.1.5 This FRA has been prepared in accordance with the requirements set out in National Policy Statements published by the Department for Energy and Climate Change (July 2011), specifically Overarching Energy Policy (EN-1) (Ref 1.2) and Electricity Networks Infrastructure Policy (EN-5) (Ref 1.3). It also complies with the Planning Practice Guidance (PPG) on Flood Risk and Coastal Change (Department for Communities and Local Government, March 2014) (Ref 1.4) which supplements the National Planning Policy Framework (NPPF) (Ref 1.5) and supersedes the Technical Guidance to the National Planning Policy Framework. This reference to the PPG is relevant because the PPG is a "successor" document to the guidance referred to in NPS EN-1.

1.1.6 This FRA is one of a series of five FRAs related to the Proposed Development. This FRA covers the modifications and extension to Seabank 400kV Substation. Separate FRAs have been prepared for:

- the Bridgwater Tee CSE compounds (**Volume 5.23.1**);
- the South of Mendip Hills CSE compound (**Volume 5.23.2**);
- Sandford Substation (**Volume 5.23.3**); and
- the overall overhead line and underground cable route from Bridgwater to Seabank (**Volume 5.23.5**).

1.1.7 Within the wider context for this FRA the Sequential Test Report (part of **Volume 5.23.5**) sets out the Sequential Test for the preferred route as a whole, and the justification for the route selection on the basis of flood risk.

1.2 Flood Risk Assessment Structure

1.2.1 The main report sections within this FRA address all of the requirements identified within the NPS, as well as those requirements in the NPPF and the PPG on Flood Risk and Coastal Change, where the NPS refers to these other planning documents. **Volume 5.23.4.2, Appendix E** lists all of the requirements within EN-1 and EN-5 and how these points have been addressed within the FRA.

1.2.2 This FRA is structured as follows:

- **Section 2** provides an overview of the site description covering physical characteristics including topography, soils, hydrogeology, hydrology and land use.

- **Section 3** covers the planning policy context specifically with regard to the FRA including the relevant National Policy Statements on energy and electricity networks, local planning documents, and the Sequential and Exception Test requirements.

- **Section 4** gives a description of the proposed works related to the modifications and extension to the existing substation.

- **Section 5** describes the flood hazard and risks associated with all flood sources including as assessment of estimated flood levels through the operational life of the substation, anticipated to be up to 2060.

- **Section 6** considers Climate Change Impacts, focused on sea level rise, increased river flows and increased rainfall intensities, covering the period to 2060. Consideration is also given to continued operation at the site beyond 2060.

- **Section 7** describes the flood risk management measures proposed for the site related to both the flood risk posed to the site and the potential impact that the site could have on flood risk elsewhere. This section also summarises how the Sequential and Exception Tests are met.

- **Section 8** summarises the main conclusions from this FRA.

- **Section 9** lists the references for the study.

2. PROPOSED SUBSTATION MODIFICATIONS AND SITE DESCRIPTION

2.1 Introduction

2.1.1 This section provides an overview of the site description covering physical characteristics including topography, soils, hydrogeology, hydrology and land use (section 2.2).

2.2 Proposed Substation Modifications Description

<u>Site Location Information</u>

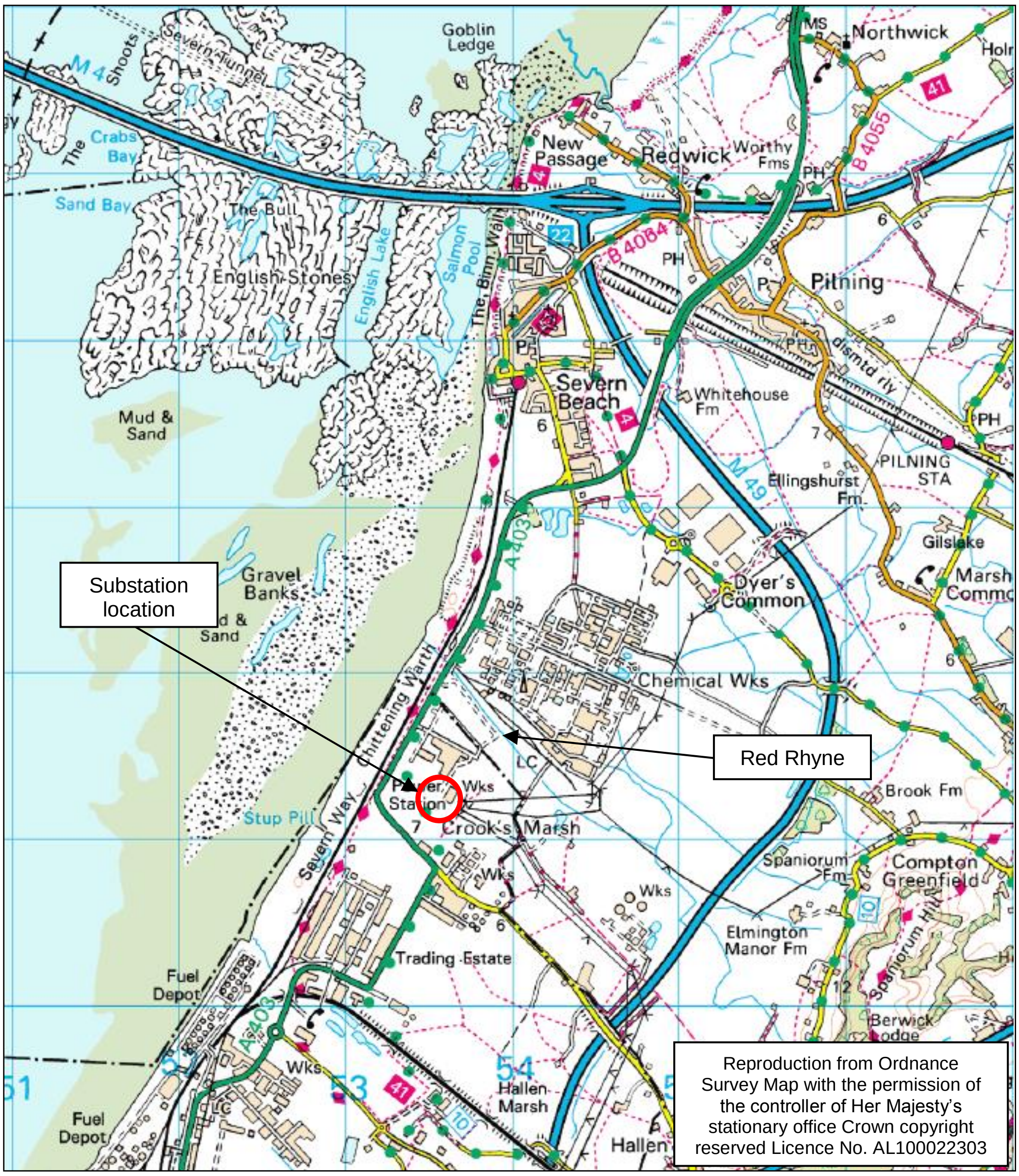
2.2.1 The existing Seabank 400kV Substation (Grid reference: ST 536 822) is located in Crooks Marsh, 0.7km inland from the Severn Estuary, 3km north of Avonmouth, and just downstream of the Second Severn Crossing. It is located within Bristol City Council's administrative area and the Wessex (North) area of the Environment Agency's South West Region. It is also within the boundary of the Lower Severn Internal Drainage Board (IDB) area.

2.2.2 The existing National Grid 400kV substation covers approximately 1.4 hectares, within which the proposed modifications would be accommodated. The existing substation neighbours a Gas Fired Power Station to the north and west, a Western Power Distribution 132kV substation to the south and a designated landfill site to the east. Further to the west, beyond other infrastructure in the area, are the tidal flood defence embankments of the Severn Estuary.

2.2.3 The proposed works at Seabank Substation are concerned with modifications and extensions to the existing 400kV substation to connect the proposed new 400kV connection from Bridgwater as part of the Hinkley Point C Connection Project and the proposed new Seabank 3 power station.

2.2.4 **Inset 2.1** shows the location plan of the existing site, within which the proposed modifications and extension works would take place.

Inset 2.1: Location Plan



Land Use and Topographical Information

2.2.5 The site is currently occupied by the existing National Grid Seabank 400kV Substation, comprising various buildings housing critical electricity transmission infrastructure and associated control equipment, as well as other equipment including large transformers located outside. There is a mixture of impermeable paved areas and permeable graveled areas.

2.2.6 The site is generally flat. The topographical survey for the site (carried out in May 2012 by Onsite for National Grid) indicates that the site ground level ranges from around 6.36 to 6.73mAOD, although a typical ground level across the site is around 6.6mAOD. Drawing no. 12/J2M/2046040 **(Volume 5.23.4.2, Appendix B)** shows the existing site layout and topographic survey levels across the site. The lowest part of the site is seen to be in the southern corner of the site with levels at around 6.4mAOD.

Soils, Geology and Hydrogeology

2.2.7 The Soil Survey of England and Wales (Sheet 5, 1:250k) (Ref 2.6) shows the local area at the site to be "unsurveyed" due to the industrial nature of the site. However, the entire area around the site is classified as "814c" and it is considered likely that the soils underlying the site are of this type, possibly including areas of made ground depending on the activities associated with the original construction of Seabank Substation. The soil and site characteristics for 814c, Newchurch 2, are described as "*Deep stoneless mainly calcareous clayey soils. Groundwater controlled by ditches and pumps. Flat land. Risk of flooding in plac*es". These soils are moderately permeable, but field drainage systems and pump drainage are necessary for efficient groundwater control.

2.2.8 The published geological map (British Geological Survey (BGS), 1:50k Sheet No. 250 Chepstow) (Ref 2.7) shows that at the site, the superficial geology is estuarine alluvium, comprising tidal flats deposits of clay and silt. The underlying bedrock is Mudstone from the Mercia Mudstone Group.

2.2.9 The superficial deposits are not designated as aquifers and are therefore considered to be unproductive strata in terms of groundwater yield. The Mercia Mudstone Group bedrock is designated as a "Secondary B" aquifer, implying predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.

Hydrology and Land Drainage

2.2.10 The site is in the vicinity of Crook's Marsh to the east and south east. The Red Rhyne is located approximately 500m to the north east of the site (see **Inset 2.1**) and drains in a north westerly direction (outside the site boundary) towards the Severn Estuary. It provides land drainage to the flat and low lying land around the site and surrounding area to the east. The land drainage system in this area discharges via a culvert underneath the A403 before discharging via an outfall sluice through tidal flood defence embankments into the Severn Estuary. The large network of drainage ditches and rhynes in the area are managed by the Lower Severn IDB. The system stores surface water runoff within the drainage network during high tides, allowing it to subsequently drain by gravity as the tide goes out.

3. POLICY OVERVIEW

3.1 Introduction

3.1.1 This section covers the planning policy context for the FRA requirements with regard to:

- the requirements of the National Policy Statements (NPS) on Energy (section 3.2);
- local development documents providing the normal local context for planning applications (section 3.3); and
- the requirements of the Sequential Test and the Exception Test (sections 3.4 and 3.5).

3.2 National Policy Statements

3.2.1 The National Policy Statements on energy infrastructure (DECC, 2011) are the primary policy documents that nationally Significant Infrastructure Projects (NSIP) must comply with. For the Proposed Development the relevant National Policy Statements are:

- Overarching National Policy Statement for Energy (EN-1) (Ref 1.2)
- National Policy Statement for Electricity Networks Infrastructure (EN-5) (Ref 1.3)

3.2.2 The main requirements related to flood risk are covered in EN-1 (Section 5.7, EN-1). Flood risk also needs to be considered within the context of the PPG on Flood Risk and Coastal Change which replaced PPS25.

3.2.3 In addition to the specific flood risk requirements there are additional requirements related to applying principles of "good design" (Section 4.5, EN-1) covering sustainable drainage and flood resilience and resistance.

3.2.4 EN-1 also makes reference to the need to consider climate change adaptation (Section 4.8, EN-1) with the following aspects specifically identified:

- resilience to changes in the hydrological cycle;
- sensitivity to extreme climate change scenarios;
- adaptive capacity; and
- consequential impacts of adaptive measures on flood risk elsewhere.

3.2.5 Within EN-5, resilience to climate change in the context of flood risk posed to a particular development (and impact from the development) is also a key consideration.

3.2.6 **Volume 5.23.4.2, Appendix E** includes a summary of the main requirements of EN-1 and EN-5 related to flood risk, along with a summary commentary of how these requirements have been considered within the full suite of FRAs.

3.3 Local Development Documents

3.3.1 The local development documents provide a local context for how flood risk is generally considered within the area, although it is noted that these do not form the final basis for decision making with regard to development consent for the Proposed Development.

3.3.2 Bristol City Council's Bristol Development Framework Core Strategy (June 2011) (Ref 3.8) identifies Flood Risk and Water Management as one of its key policies to deliver its strategic objectives. Policy BCS16 sets out the requirements of the Sequential Test for applicants:

"Development in Bristol will follow a sequential approach to flood risk management, giving priority to the development of sites with the lowest risk of flooding. The development of sites with a sequentially greater risk of flooding will be considered where essential for regeneration or where necessary to meet the development requirement of the city.

Development in areas at risk of flooding will be expected to:

- *be resilient to flooding through design and layout, and/or*
- *incorporate sensitively designed mitigation measures, which may take the form of on-site flood defence works and/or a contribution towards or a commitment to undertake such off-site measures as may be necessary,*

in order to ensure that the development remains safer from flooding over its lifetime.

All development will also be expected to incorporate water management measures to reduce surface water runoff and ensure that it does not increase flood risk elsewhere. This should include the use of sustainable drainage systems (SuDS)".

3.3.3 For the consideration of development sites outside of Flood Zone 1 the Core Strategy states:

"Where it does become necessary to consider development on land with a greater risk of flooding, development will… be expected pass the Exception Test, which assesses the development against other considerations such as its broader sustainability benefits, the use of previously developed land and the potential to make the development safe through mitigation".

3.3.4 For the proposed substation modifications there is a specific locational requirement based on the existing location of the Seabank 400kV Substation and its connection to the National Grid transmission system.

3.4 Sequential Test

3.4.1 **Volume 5.2.1** describes the details of the need case and alternatives considered with regard to electricity transmission infrastructure development. This sets the wider context for the Sequential Test for the Proposed Development, which seeks to direct development towards areas of lowest flood risk. Details of the Sequential Test for the Proposed Development as a whole are included in the Sequential Test Report as part of the Hinkley Point C Connection Route FRA appendices (**Volume 5.23.5.2**).

<u>Need for the Connection</u>

3.4.2 National Grid operates the high voltage electricity transmission system in Great Britain and owns the system in England and Wales. The system operates at 400,000 and 275,000 volts, connecting the electricity generators to substations where the high voltages are transformed to lower voltages, enabling the power to be distributed to homes and businesses.

3.4.3 In September 2007, National Grid received an application for the connection of a new nuclear power station at Hinkley Point, Somerset (Hinkley Point C Power Station) to the high voltage electricity transmission system. This connection, in combination with others in the South West and South Wales and Gloucestershire, triggered the need for new transmission capacity in the region.

3.4.4 A detailed explanation of the need for the Proposed Development is contained in National Grid document 'Need Case for the South West and South Wales and Gloucestershire Regions' (2014) (‘Need Case’) (Ref 1.1).

<u>Project Development Process</u>

3.4.5 Developing a scheme to connect Hinkley Point C Power Station to the National Grid high voltage transmission system has included the following steps:

- strategic optioneering: to confirm the need and develop and assess strategic options that would meet the identified need, including assessment of alternative technologies, high level environmental constraints and costs and selection of the option to take forward;
- Route Corridor Study (RCS): to take account of environmental constraints and define potential areas of land or 'route corridors' for the new connection and identify the most appropriate option to meet the need;
- initial consultation: to obtain the views of statutory bodies, other agencies and the general public on the potential route corridors;
- back-check and review of options: to take the opportunity before corridor selection to verify whether the need case and review of strategic options remained valid in light of any changes in circumstances and consider representations received;
- route corridor selection: to consider and evaluate which of the possible route corridors would be preferred and once identified announce the preferred corridor;
- assessment of impact of infrastructure changes on the local electricity network and development of options to ensure electricity supplies are maintained

(resulting from the proposed removal of existing 132kV overhead lines and where the Proposed Development interacts with the existing local electricity network);

- development of draft route: develop the connection detail within the preferred route corridor and consult on this;
- Environmental Impact Assessment (EIA) Scoping Report: outline the approach and scope of the EIA for the project;
- statutory pre-application consultation: consult statutory bodies, other non-statutory bodies and the general public on details of the proposed application, including the Preliminary Environmental Information and seeking views on specific design details;
- consultation feedback report: review of representations received during the statutory pre-application consultation;
- change control: Consideration of all suggestions to amend the Proposed Development following Stage 4 consultation; and
- preparation of application and its submission to the Planning Inspectorate (PINS).

Alternatives Considered

3.4.6 National Grid considered options to connect the new Hinkley Point C Power Station to the transmission system and evaluated options as part of the strategic optioneering process, which is detailed in a separate National Grid report 'Hinkley Point C Connection Strategic Optioneering Report' (December 2009) (Ref 3.9).

3.4.7 Options considered included the potential to upgrade the existing transmission system. However this would not adequately meet the requirements set out in the need case and established that additional capacity would still be required.

3.4.8 Options that were compliant with the requirements of the National Electricity Transmission System Security and Quality of Supply Standard (SQSS) were assessed in more detail and two main route corridors with option 1 having two variants: A and B.

3.4.9 Route Corridor 1 Option 1B considered the construction of a new 400kV overhead line parallel to the existing Western Power Distribution (WPD) 132kV overhead line, either to the east or west of the existing overhead line. The existing WPD 132kV overhead line would not be removed.

3.4.10 Route Corridor 2 involved the construction of a new 400kV overhead line between Bridgwater and Seabank Substation. This route corridor aimed to avoid the paralleling of overhead lines, although this would not be possible in certain locations due to environmental constraints and urban areas. The existing WPD 132kV overhead line would not be removed.

3.4.11 The RCS proposed that Route Corridor 1 Option 1A was the least environmentally constrained corridor as it would result in the replacement of an existing 132kV overhead line with a 400kV overhead line. The relatively wide corridor identified for much of the route would also allow an alignment to be identified to minimise the scale of change and effects on the environment.

Sequential Test for the Proposed Substation Modifications

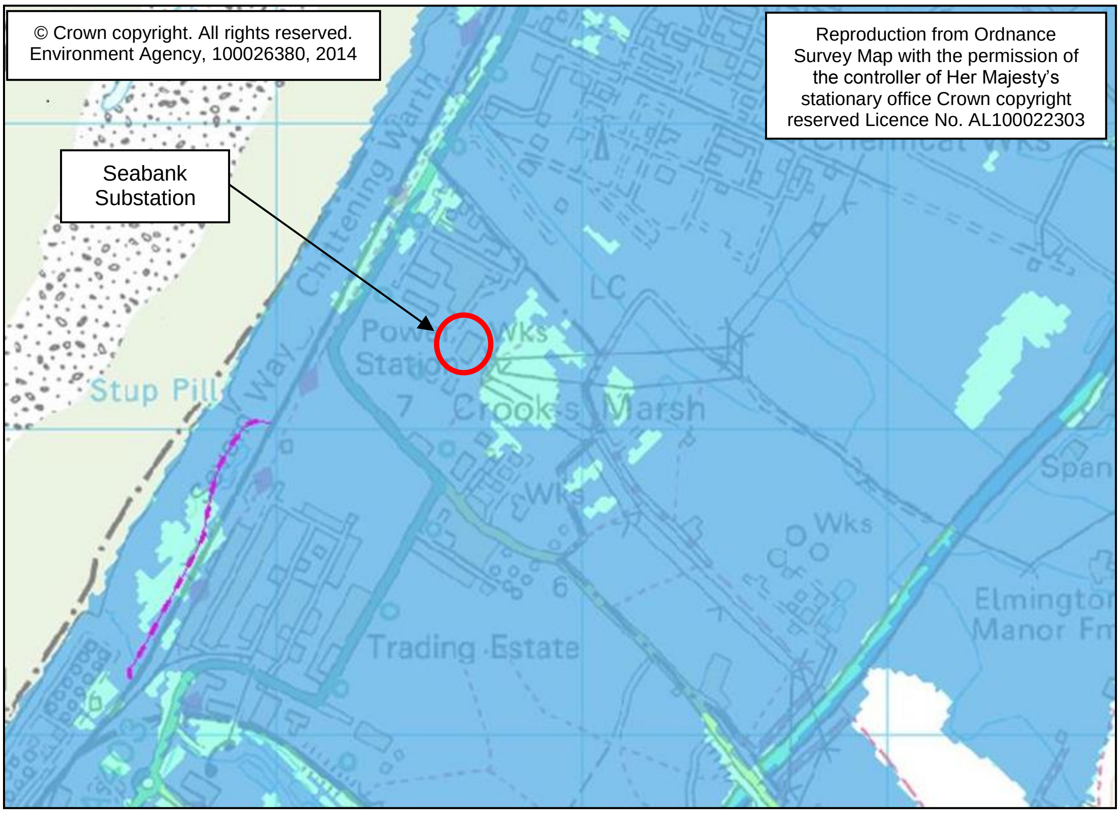
3.4.12 The context for the upgrade to Seabank 400kV Substation is set within this wider context for the Proposed Development and the previously agreed strategic option to connect at Seabank Substation that in turn connects to the existing National Grid main interconnected transmission system. The Sequential and Exception Tests are then applied within the constraints of the existing Seabank site.

3.4.13 Seabank Substation is critical to the entire Hinkley Point C Connection project as the termination point for the new connection which links to the existing National Grid network north of Bridgwater and then westwards from Bridgwater on to Hinkley Point.

3.4.14 The proposed connection route is included in **Inset 3.1** (**Volume 5.23.4.2, Appendix A**) to provide a context for the proposed modifications to Seabank Substation.

3.4.15 The site is wholly located within Flood Zone 3 with a 'High Probability' of flooding. This is defined as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year. This ignores the presence of existing defences, based on the Environment Agency Indicative Floodplain Map as shown in **Inset 3.2**.

Inset 3.2: Environment Agency Indicative Flood Map



Key to flood risk map:

Dark blue:	Flood Zone 3 - More frequent than 1 in 200 (0.5%) annual probability event for tidal flooding, or 1 in 100 (1%) for fluvial flooding
Light blue:	Flood Zone 2 – Between 1 in 200 and 1 in 1000 (0.5% and 0.1%) annual probability events for tidal flooding, or between 1 in 100 and 1 in 1000 (1% and 0.1%) for fluvial flooding
White:	Flood Zone 1 - Less frequent than 1 in 1000 (0.1%) annual probability for tidal or fluvial flooding.
Purple dotted line:	Flood defences.

Note: *These maps are subject to change and are only as current as the latest data held by the Environment Agency.*

3.4.16 The NPPF Planning Practice Guidance (PPG) (Ref 1.4) on Flood Risk and Coastal Change requires decision-makers to steer new development to areas at the lowest probability of flooding by applying a 'Sequential Test'. Given its proposed location in Flood Zone 3 the Sequential Test must be passed. Within the constraints of the requirement to upgrade to the existing Seabank Substation, there are no other suitable locations at lower flood risk within the site boundary. The area of Flood Zone 2 located immediately to the east of the site is a landfill site.

3.4.17 In accordance with the PPG, only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 be considered, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required.

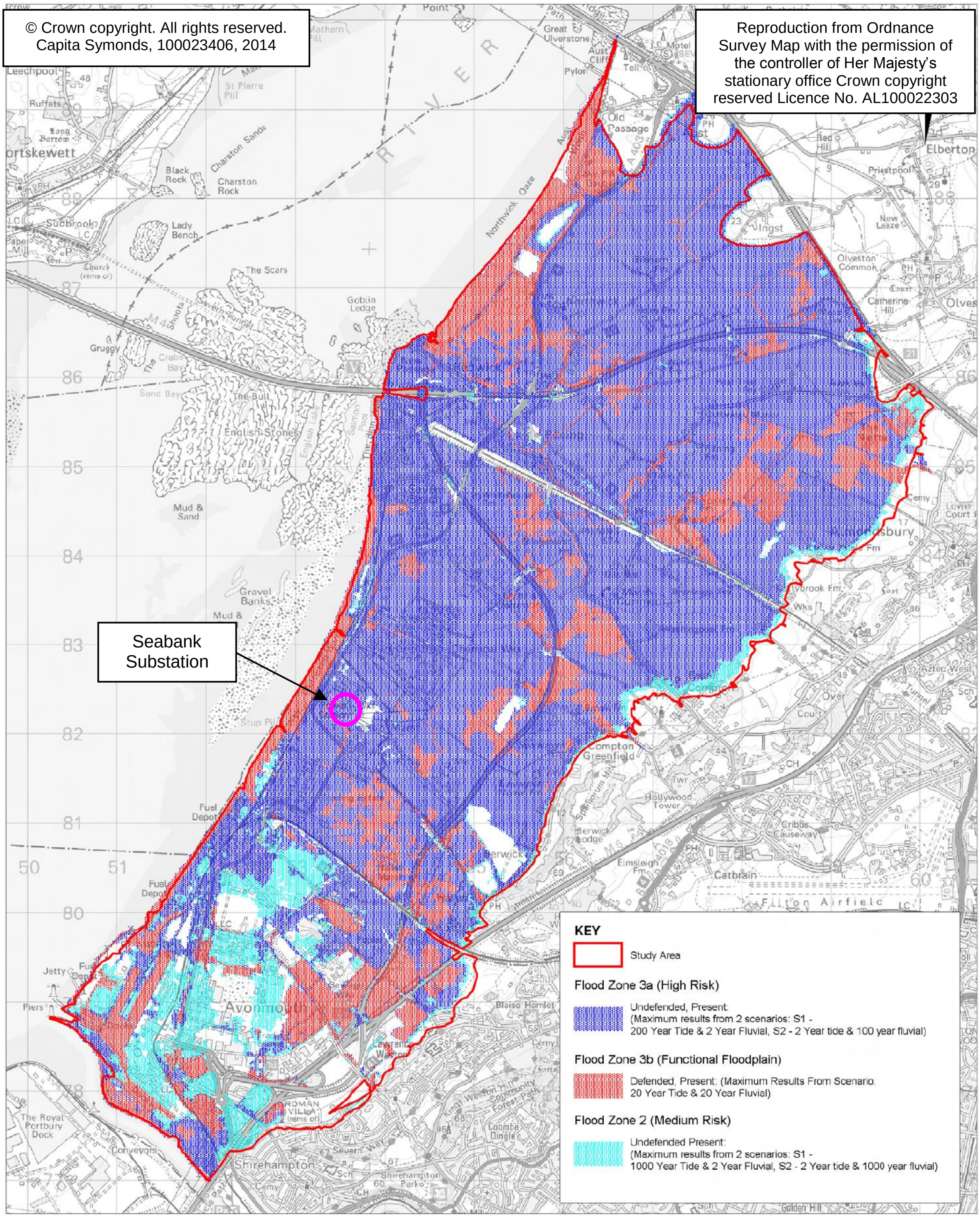
3.4.18 The Avonmouth/Severnside Strategic Flood Risk Assessment (SFRA) (2011) (Ref 3.10) develops the Environment Agency Flood Zones further by delineating Flood Zones 3a and 3b. Zone 3a is land assessed as having a 1 in 100 (1%) or greater annual probability of river flooding or 1 in 200 (0.5%) or greater annual probability of tidal flooding, while Zone 3b is referred to as the functional flood plain, having an annual probability of flooding of 1 in 20 (5%) or greater from either fluvial or tidal sources. **Inset 3.3** shows the whole of the existing Seabank 400kV Substation to be in Flood Zone 3a.

3.4.19 Table 3 of the PPG on Flood Risk and Coastal Change shows the Flood Zones and the appropriate uses within each Flood Zone. For Flood Zone 3a the requirements state:

"In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood."

3.4.20 The flood risk vulnerability classification given in Table 2 of the PPG indicates that the substation and proposed modifications are "Essential Infrastructure". Given there are no lower risk Flood Zones available on the existing site, it therefore passes the Sequential Test, subject to the requirement that the development could remain operational and safe in times of flood.

Inset 3.3: Level 2 SFRA Flood Mapping with Seabank Substation Location
(Source: Avonmouth/Severnside Level 2 SFRA, Capita Symonds, 2011)



3.5 Exception Test

3.5.1 In addition to the requirement to pass the Sequential Test, for "Essential Infrastructure" to be located in Flood Zone 3a the Exception Test must also be passed, as shown in **Table 3.1** below, which shows the Flood Risk Vulnerability and Flood Zone Compatibility (from Table 3 of the PPG on Flood Risk and Coastal Change).

Table 3.1 Flood Risk Vulnerability and Flood Zone Compatibility

Flood Risk Vulnerability Classification		Essential Infra-structure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Flood Zone	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	Exception Test Required	✓	✓	✓
	Zone 3a	Exception Test Required	×	Exception Test Required	✓	✓
	Zone 3b	Exception Test Required	×	×	×	✓

Key:
✓ Development is appropriate
× Development should not be permitted

3.5.2 The National Planning Policy Framework, paragraph 102 (referenced from the PPG on Flood Risk and Coastal Change) describes the requirements of the Exception Test as follows:

"*If, following application of the Sequential Test, it is not possible, consistent with wider sustainability objectives, for the development to be located in zones with a lower probability of flooding, the Exception Test can be applied if appropriate.*

For the Exception Test to be passed:

- *it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and*
- *a site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.*

Both elements of the test will have to be passed for development to be allocated or permitted."

3.5.3 With regard to the first requirement, as noted above, the need for the Hinkley Point C Connection project has already been established through the *Need Case for the South West and South Wales and Gloucestershire Regions* (2014) document that outlined the requirement for new transmission infrastructure in the region. This is as a result of the drive towards a low-carbon economy, of which Hinkley C forms a part. Without the new transmission infrastructure it is anticipated that by 2018 there will be insufficient transmission infrastructure for the new power generation plants to connect to. This will have a negative impact on the economy and will be detrimental to wider sustainability benefits if there is insufficient transmission infrastructure to enable new low-carbon power generation plants to connect to the transmission grid.

3.5.4 Additionally, the site is defined as a "Principal Industrial and Warehousing" area as outlined in the Bristol Development Framework Core Strategy, which is integral to the continued industrial development of Avonmouth.

3.5.5 For the second requirement, this FRA considers flooding from all sources over the lifetime of the substation, taking account of the users and the impact of flooding elsewhere. The identification and assessment of flood risk is addressed in section 5, with climate change considerations and mitigation measures considered in sections 6 and 7 respectively.

3.5.6 National Policy Statement EN-1, (Overarching National Policy Statement for Energy) identifies the following requirements for the Exception Test:

- *"it must be demonstrated that the project provides wider sustainability benefits to the community that outweigh flood risk;*
- *the project should be on developable, previously developed land or, if it is not on previously developed land, that there are no reasonable alternative sites on developable previously developed land subject to any exceptions set out in the technology-specific NPSs; and*
- *a FRA must demonstrate that the project will be safe, without increasing flood risk elsewhere subject to the exception below and, where possible, will reduce flood risk overall".*

Exceptionally, where an increase in flood risk elsewhere cannot be avoided or wholly mitigated, the IPC may grant consent if it is satisfied that the increase in present and future flood risk can be mitigated to an acceptable level and taking account of the benefits of, including the need for, nationally significant energy infrastructure…. In any such case the IPC should make clear how, in reaching its decision, it has weighed up the increased flood risk against the benefits of the project, taking account of the nature and degree of the risk, the future impacts on climate change, and advice provided by the EA and other relevant bodies."

3.5.7 With regard to the first requirement above – providing wider sustainability benefits - this is covered by the first point of the Exception Test as set out in the NPPF.

3.5.8 With regard to the second requirement above, the proposed modifications would be located on a previously developed site i.e. the existing Seabank 400kV Substation.

3.5.9 With regard to the third requirement – demonstrating that the "project" would be safe – this is covered by the second point of the Exception Test as set out in the

NPPF. As noted above, the identification and assessment of flood risk is addressed in section 5 of this FRA, with climate change considerations and mitigation measures considered in sections 6 and 7 respectively.

3.5.10 Taking account of how the requirements of the Exception Test are expressed slightly differently within the NPPF and National Policy Statement EN-1, the remainder of this FRA seeks to address all of these requirements. However, the underlying reason for the difference in how the Exception Test requirements are expressed is due to revisions to planning policy with regard to flood risk as follows:

- **Planning Policy Statement 25:** Development and Flood Risk – Published in March 2010, this set out the Exception Test using the three main points of the Exception Test.
- **National Energy Policy Statement EN-1** – Published in July 2011, this references PPS25 with regard to many aspects of development and flood risk, and draws significantly from the Exception test as expressed in PPS25.
- **National Planning Policy Framework** – Published in March 2012 this supersedes PPS25 and removes the requirement relating to previously developed land. It is emphasised that the NPPF remains in place, but the Technical Guidance to the NPPF is now superseded by the PPG on Flood Risk and Coastal Change (March 2014).

3.5.11 Consideration of how the Sequential and Exception Tests are met is addressed specifically in section 7.9 of this FRA.

4. SUBSTATION MODIFICATIONS DEVELOPMENT PROPOSAL

4.1 Introduction

4.1.1 This section gives a description of the proposed works related to the modifications at Seabank 400kV Substation.

4.2 Details of Substation Modifications

4.2.1 To facilitate connection of the proposed 400kV overhead line into Seabank Substation an extension to the existing substation building of approximately 24m and a minor extension to the substation perimeter fence are required together with the installation of electrical plant, equipment and switchgear.

4.2.2 There is currently a 400kV Gas Insulated Switchgear (GIS) Substation at Seabank (Grid Reference ST 536 822). The proposed extension to the existing 400kV Seabank Substation would comprise extending the steel framed switchgear building and annex, electrical switchgear, Gas Insulated Busbar (GIB), steel support structures and ancillary buildings. A 400/132kV Super Grid Transformer (SGT) would be removed to enable the works.

4.2.3 At the southern extent of the substation compound, modifications in the form of new cable sealing ends would be required to facilitate the underground connections to the 132kV Seabank Substation.

4.2.4 With regard to the modification at the site resulting in changes to the impermeable area, the proposed extension to the existing building has an area of approximately 374m^2, (23.8m long by 15.7m wide). Its annex extension has an area of 90m^2 (12.2m long by 7.4m wide). The indicative layout of the substation is shown in Drawing no. 12/J2M/2046055 in **Volume 5.23.4.2, Appendix B**. Part of the existing site, where the proposed extension of the switchgear building would be located, already has an impermeable concrete surface. The actual net increase in impermeable area as a result of the building extension is only 110m^2. The SGT and its cooler unit, which would be removed as part of the modifications, have a total impermeable area of 189m^2.

4.2.5 Therefore, there would be a net reduction in impermeable area at the site of 79m^2 (an addition of 110m^2 related to the new building extension and removal of 189m^2 related to the SGT removal). This approach to balancing, and providing an improvement over the existing situation is a key part of the SuDS strategy for the site.

4.2.6 Concrete foundations and steel support structures are proposed for the associated GIB equipment. These would be impermeable areas, with runoff from these flowing directly to adjacent permeable areas. The new access road at the entrance would be realigned on the existing concrete slab and therefore there would be no further increase in the impermeable road surface.

4.2.7 For the rest of the site area, the surface would be covered with gravel. The use of gravel is beneficial from a hydrological perspective to minimise runoff from the site, allowing water to drain freely through the gravel to the underlying soil.

4.2.8 There is an existing piped drainage system at the substation, with a sump and pump arrangement to discharge surface water from the site to the adjacent surface water system serving the area. This system would continue to operate after the modifications are made.

4.2.9 These approaches to managing surface water at the site follow the (SuDS) principles as required under the Flood and Water Management Act 2010.

4.2.10 The proposed finished floor level of the building is around 6.6mAOD, consistent with the existing finished level at the site.

5. FLOOD HAZARD

5.1 Introduction

5.1.1 This section considers the potential flood hazards present at the substation site. There is a specific focus on each flood source at the site (sections 5.2 and 5.3) followed by an overview of existing plans and policies which provides the wider flood risk management context and other details that inform flood risk related to the substation site (section 5.4).

5.2 Sources of Flooding

5.2.1 The PPG on Flood Risk and Coastal Change requires that an assessment of all potential sources of flooding is undertaken. The following potential sources have been considered:

- fluvial;
- tidal;
- pluvial (surface water);
- groundwater;
- sewer; and
- reservoirs and other artificial sources.

5.3 Description of Potential Flood Risk

Fluvial Flooding

5.3.1 The site is not at risk from fluvial flooding from any natural watercourses. There is an extensive network of drainage ditches which are managed by the Lower Severn Internal Drainage Board (IDB). The system of rhynes and detention ponds has significant capacity to contain water drained from the land during a high tidal event. This stored water is discharged when the tide falls below a threshold level.

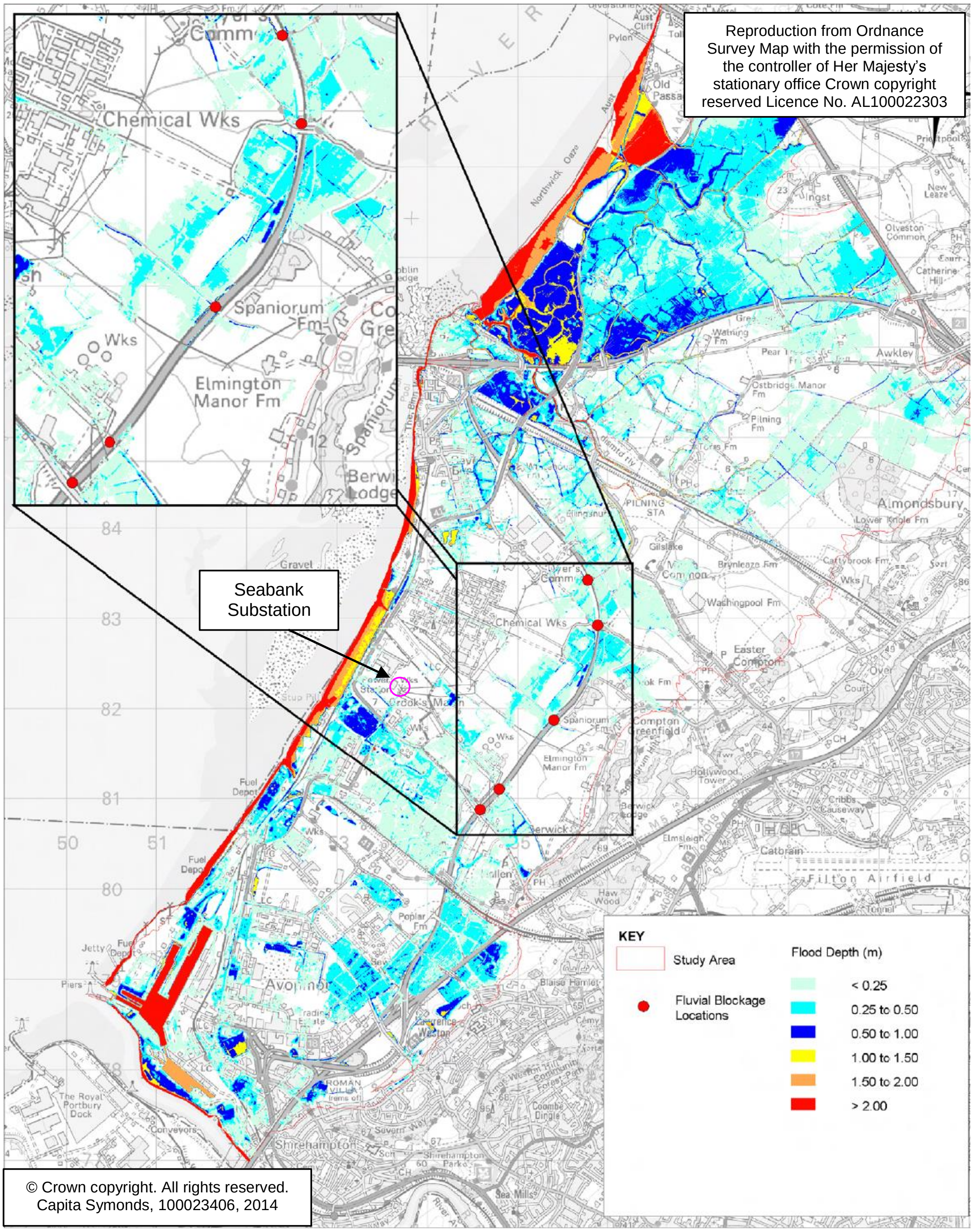
5.3.2 The Avonmouth/Severnside Level 2 SFRA (Ref 3.10) considered fluvial flooding from the network of rhynes in the area. For the Crook's Marsh area specifically (in which the Seabank Substation is located), the hydraulic modelling for the 1 in 100 (1%) annual probability fluvial event showed localised flooding around the rhyne network. As a further check on fluvial flood risk, the effects of possible blockages in culverts under the M49 were considered. Simulations were carried out for the 1 in 1000 (0.1%) and 1 in 100 (1%) annual probability fluvial events, coincident with the 1 in 2 (50%) annual probability tide levels for a future climate change scenario in 2110. These simulations indicated that the blockage of the culverts would have little or no influence on flood levels in the vicinity of the blockages.

5.3.3 The fluvial flood risk maps for these scenarios were included in the SFRA. **Inset 5.1** shows the 1 in 1000 (0.1%) annual probability fluvial event with the 1 in 2 (50%) annual probability tide level for the future case in 2110. The flood outline indicates that even in this extreme fluvial scenario the site is outside the flooded area.

5.3.4 The risk of flooding from fluvial sources and from the drainage network in general is **low.**

Inset 5.1: Level 2 SFRA Flood Mapping – 1 in 1000 (0.1%) fluvial event and 1 in 2 (50%) Tide, Future Case.

(Source: Avonmouth/Severnside Level 2 SFRA, Capita Symonds, 2011)



Tidal Flooding

5.3.5 Tidal flooding is a risk at the site due to its location on low lying land, behind tidal defences along the Severn Estuary. These defences being in place define the 'defended' situation for the area, and form part of an extensive length of defences to provide protection against extreme tide levels in the area stretching from Avonmouth 3km to the south of the site, to Aust approximately 8km north east of the site. The flood defence level close to the Seabank Substation site along the Severn Estuary is 9.33mAOD.

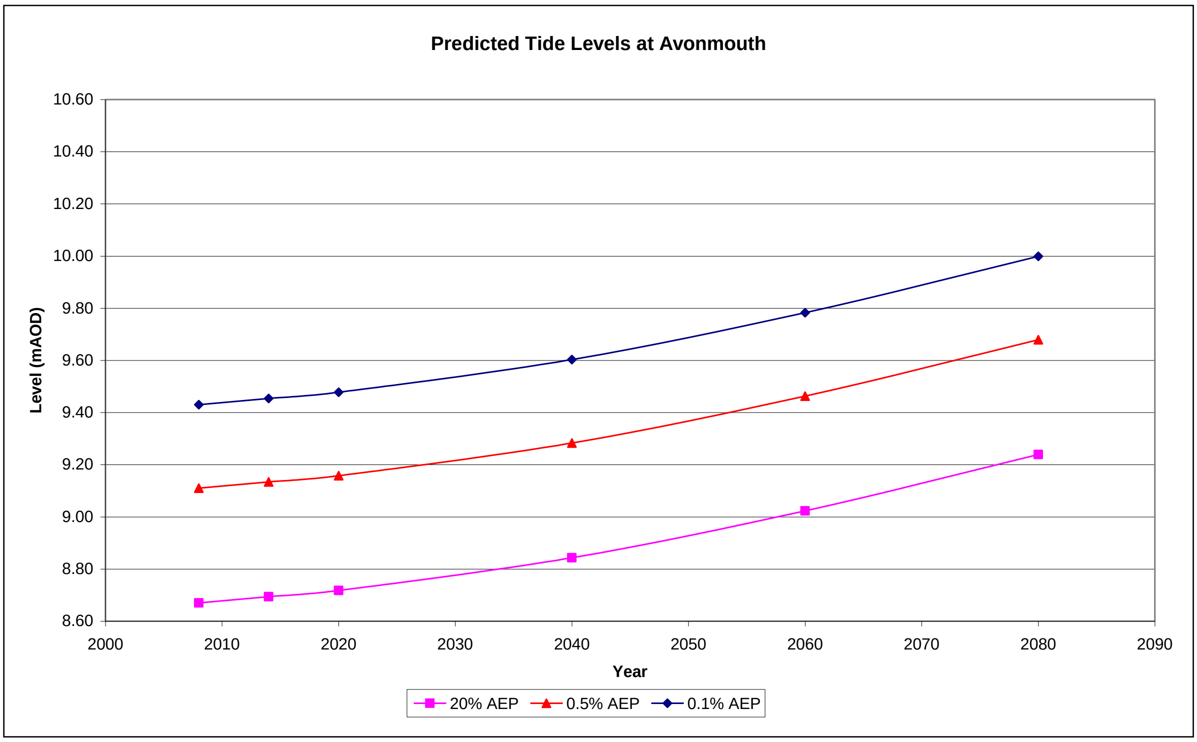
5.3.6 **Table 5.1** shows the projected tidal still water levels at Avonmouth, based upon the "Coastal Flood Boundary Conditions for UK Mainland and Islands" study report (Environment Agency, 2011) (Ref 5.11) with the base year for the data of 2008. An allowance has been made for sea level rise in accordance with the UKCP09 projections (Ref 5.12) using the "upper end estimate" as defined in Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities (Environment Agency, 2011) (Ref 5.13). This approach meets the requirements for the climate change assessment identified within the EN-1 National Policy Statement for Energy (DECC, 2011). The sea level rise allowances included for the UKCP09 upper end estimates are 4mm per year up to 2025, 7mm per year from 2026 to 2050, and 11mm per year from 2051 to 2080. This gives a total rise of 353mm from 2008 (the base date for the "Coastal Flood Boundary Conditions for UK Mainland and Islands") to 2060 which would be the anticipated end of operational life of the substation.

5.3.7 This information is presented graphically in **Inset 5.2**.

Table 5.1 Predicted Tidal Still Water Levels (adjusted for sea level rise) at Avonmouth

Predicted Levels (mAOD)	2008	2014	2020	2040	2060	2080
1 in 20 (5%) annual probability	8.67	8.69	8.72	8.84	9.02	9.24
1 in 200 (0.5%) annual probability	9.11	9.13	9.16	9.28	9.46	9.68
1 in 1000 (0.1%) annual probability	9.43	9.45	9.48	9.60	9.78	10.00
Notable high tide	8.83					

Inset 5.2 Predicted Tide Levels at Avonmouth



5.3.8 These levels indicate that at present, in the 'undefended' situation, even the 1 in 20 (5%) annual probability tide level would be approximately 2m above ground level at the site which is approximately between 6.4 and 6.7mAOD.

5.3.9 These tide levels shown in **Table 5.1** however, do not represent the current tidal flood levels at the site as it is protected by the tidal defences. The tidal flood risk for the defended situation is based on the Avonmouth/Severnside SFRA analysis of risk of the defences either being overtopped or being breached.

5.3.10 The SFRA estimated flood depths due to various overtopping and breach scenarios for the present day (base year of 2010) and future conditions in 2110. The most relevant of these model outputs as they relate to the site are summarised in **Table 5.2**. The key relevant flood maps and flood hazard maps are shown in **Insets 5.3 to 5.8 in Volume 5.23.4.2, Appendix C**. The flood "Hazard" score shown in **Table 5.2** is a function of water depth and flow velocity, with a debris factor also included.

Table 5.2 Estimated Flood Depths and Flood Hazard Score at Seabank Substation

Event Analysis	**Figure from SFRA (and Inset in Appendix C)**	**Estimated Flood Depth at Seabank (m)**	**Seabank Peak Flood Hazard Info**
Hydraulic modelling to define Actual Risk - 1 in 200 (0.5%) annual probability of flooding			
Current case 2010: Worst of: Scenario 1 – 1 in 200 tide, 1 in 2 fluvial, OR Scenario 2 – 1 in 100 fluvial, 1 in 2 tide	7.19 (Inset 5.3, App. C)	<0.25	
	7.20		Danger for some 0.75 to 1.50
Future case 2110: Worst of: Scenario 1 – 1 in 200 tide, 1 in 2 fluvial, OR Scenario 2 – 1 in 100 fluvial, 1 in 2 tide	7.3 (Inset 5.4, App. C)	1.00 to 1.50	
	7.4		Danger for most 1.50 to 2.50
Hydraulic modelling to define Residual Risk - 1 in 1,000 (0.1%) annual probability of flooding			
Current case 2010: Scenario 1 – 1 in 1,000 tide/surge/wave, 1 in 2 fluvial with defence	7.21 (Inset 5.5, App. C)	0.25 to 0.50	
	7.22		Danger for some 0.75 to 1.50
Future case 2110: Scenario 1 – 1 in 1,000 tide/surge/wave, 1 in 2 fluvial with defence	7.15 (Inset 5.6, App. C)	1.50 to 2.00	
	7.16 (Inset 5.7, App. C)		Mainly “Danger for most” 1.50 to 2.50 and some “Danger for all” 2.50 to 20.00
Breach modelling to define Residual Risk (Future case)			
Breach 1 Scenario 1 – 1 in 1,000 tide, 1 in 2 fluvial	7.6 (Inset 5.8, App. C)		Partial danger for most 1.50 to 2.50 and Danger for all 2.50 to 20.00

5.3.11 Subsequent to the Avonmouth/Severnside SFRA, Bristol City Council (BCC) has recently updated the SFRA (2013) (Ref 5.14) to produce flood maps for the year 2073. The relevant model outputs as they relate to the site are summarised in **Table 5.3** below. The key relevant flood maps are shown in **Insets 5.9 to 5.11** in **Volume 5.23.4.2, Appendix C**. This information provides the basis for an interim evaluation of climate change impacts at the site in the event that the site continues to be used beyond the currently planned operational lifetime of the site to 2060.

Table 5.3 Estimated Flood Depths at Seabank Substation from Updated SFRA (2013)

Event Analysis	Figure from Updated SFRA (and Inset in Appendix C)	Estimated Flood Depth at Seabank (m)
Future case 2073: Worst of: Scenario 1 – 1 in 200 tide, 1 in 2 fluvial, OR Scenario 2 – 1 in 100 fluvial, 1 in 2 tide	Appendix B1 (Inset 5.9, App. C)	0.50 to 1.00
Future case 2073: Scenario 1 – 1 in 1,000 tide & 1 in 2 fluvial	Appendix B6 (Inset 5.10, App. C)	1.00 to 1.50
Future case 2073: Breach Scenario 1 – 1 in 1,000 tide & 1 in 2 fluvial	Appendix B9 (Inset 5.11, App. C)	1.00 to 1.50

Overtopping Scenario Analysis

5.3.12 The SFRA (2011) tidal flood analysis shows that in the defended situation under the present day conditions (base year of 2010), there is some flooding to Seabank Substation site with an estimated flood depth of less than 0.25m for the 1 in 200 (0.5%) annual probability event (**Volume 5.23.4.2, Appendix C, Inset 5.3**). For the 1 in 1,000 (0.1%) annual probability event, the predicted flood depth is between 0.25 to 0.5m (**Volume 5.23.4.2, Appendix C, Inset 5.5**).

5.3.13 Under a climate change scenario taking account of sea level rise to 2110, the worst flooding of the study area occurs under the overtopping scenario, based on projected levels for a 1 in 1,000 (0.1%) annual probability event in 2110, which shows flood depths across the site to be from 1.5m to 2.0m (**Volume 5.23.4.2, Appendix C, Inset 5.6**). For a similar event in 2073, the predicted flood depth from the updated SFRA (2013) is between 1.0m to 1.5m (**Volume 5.23.4.2, Appendix C, Inset 5.10**).

5.3.14 The Level 2 SFRA (2011) report states that during a future day 1 in 1000 (0.1%) annual probability event: *"The second tidal peak is the biggest of the three peaks. The highest tide/surge levels also correspond to the highest wave overtopping inflows. Due to these tidal/surge and wave inflows the entire area is completely inundated, with depths significantly large west of the M49 and north of the M4".* The existing Seabank Substation falls under this area (west of the M49) and is of significant concern under a climate change scenario.

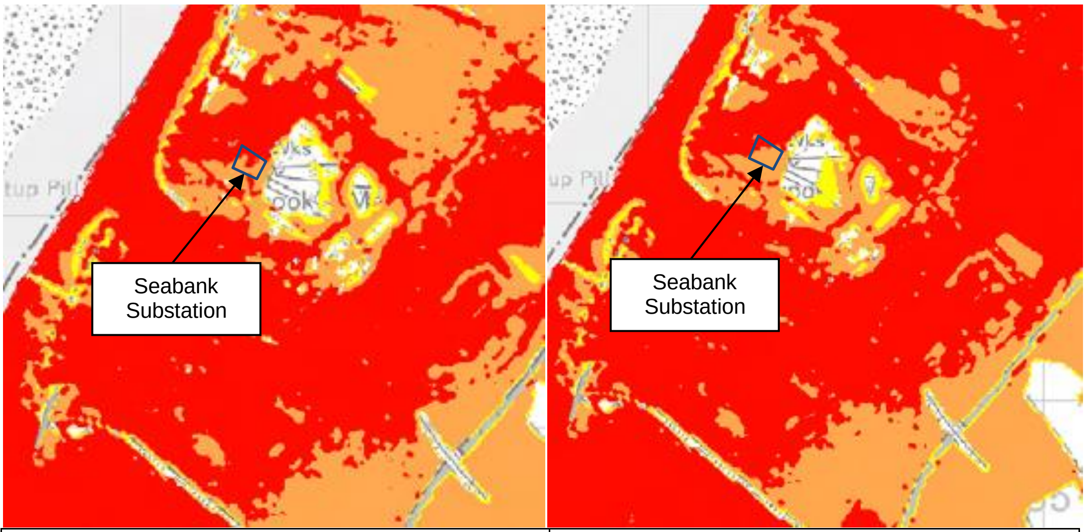
Breach Scenario Analysis

5.3.15 The SFRA (2011) also considered the impact of a defence breach or failure at six locations along Severn Estuary where the likely probability of failure of the tidal defence was estimated to be significant, or the consequence of failure was significant. Out of the six breach scenarios, Breach Scenario 1 gave the worst case situation. This is the most southerly of the breach locations considered, and is located approximately 1.8km north of the site. The flood hazard map generated (from the SFRA) focusing on the area around the existing substation site is shown in **Inset 5.12** for two scenarios – a breach scenario and an overtopping scenario. Comparison of the future case of the 1 in 1,000 (0.1%) annual probability overtopping event against the future case Breach Scenario 1 shows that the flood risk at the Seabank site is slightly worse for the overtopping event (**Inset 5.12a**). This is indicated by the slightly larger area of "red" compared to that shown in **Inset 5.12b** for the breach scenario in the vicinity of the site.

5.3.16 However, the difference in flood hazard is minor, with both having a flood hazard category that is predominantly "Danger for most" (with a Hazard score of 1.50 – 2.50) with parts of the site indicating "Danger for all" (with as Hazard score of 2.50 to 20.00).

5.3.17 It is therefore concluded to use the overtopping scenario as the basis for the analysis of the tidal flood risk under the defended situation.

Inset 5.12: Flood Hazard Mapping for: (a) Overtopping; and (b) Breach 1 Scenario



(a) Overtopping Scenario (from Inset 5.6 in Appendix C)	(b) Breach 1 Scenario (from Inset 5.7 in Appendix C)

Selected Tidal Flood Hazard Scenario

5.3.18 As noted above, the overtopping scenario represents a worse case than the various breach scenarios, in terms of flood risk at the site.

5.3.19 The water depth for the overtopping scenario in 2110, in a 1 in 1,000 (0.1%) annual probability event is shown in **Inset 5.6** (**Volume 5.23.4.2, Appendix C**). This indicates that at the site, the depth of water in a 1 in 1,000 (0.1%) annual probability event in 2110 would be in the range 1.5m to 2.0m. For the present day scenario, the flood depth is between 0.25 to 0.50m, as indicated in **Inset 5.5** (**Volume 5.23.4.2, Appendix C**). Assuming a conservative interpolation between 2010 and 2110, the estimated depth in around 2060, just beyond the end of the planned life of the project, would be in the range 0.88m to 1.25m i.e. the lower value of the depth range of 0.88m is midway between 0.25m and 1.50m depth, and the upper end value of 1.25m is midway between 0.5m and 2.0m.

5.3.20 This demonstrates that whilst at present the flood depth in the 1 in 1,000 (0.1%) annual probability event would be relatively small, up to 0.5m, by the end of the development design life of 40 years, the risk would have considerably increased, giving a maximum flood depth of up to 1.25m. With a minimum ground level at the site of around 6.40mAOD, this gives an estimated flood level at the site of around 7.65mAOD.

5.3.21 The proposed operational life of the substation is 40 years although Hinkley Point C Power Station would be likely to generate power for an estimated 60 years. Therefore, consideration is given to operation for a further 20 years. This would give an estimated flood level of 7.87mAOD based on a further 20 years of sea level rise at 11mm per year from 2060 to 2080. This compares well to the estimated level of 7.90m AOD (flood depth of up to 1.5m above the ground level of 6.4mAOD) at 2073 based on the SFRA (2013) mapping. The required defence level would be reviewed in the future, taking into consideration of the climate change impacts, and flood risk management strategies change in place at that time. This approach is consistent with a managed adaptive response to climate change.

5.3.22 As the ground level at the site is on average around 6.6mAOD, there is a significant tidal flood risk even in the defended situation.

5.3.23 Overall, the risk of tidal flooding at the site is **high** even for the defended situation.

5.3.24 The design of the extensions and modifications of the Seabank Substation and its layout therefore needs to take account of the flood levels being significantly higher than the ground level, by employing suitable mitigation measures for this flood risk. The specific requirement of the Sequential Test for Essential Infrastructure to be permitted in Flood Zone 3a, as set out in the PPG on Flood Risk and Coastal Change is that it *"should be designed and constructed to remain operational and safe in times of flood".*

Pluvial (Surface Water) Flooding

5.3.25 The site is surrounded by industrial land and significant areas of hard standing including the existing substation and adjacent power station and roads.

5.3.26 The topography of the area is generally flat and is served by land drainage networks as well as highway drainage and surface water drainage systems. Any surface water runoff from "greenfield" areas would typically flow into the network of drainage ditches which generally follow the field boundaries. It is anticipated that surface water issues would only affect localised depressions. Water falling on to the hard standing areas would be drained via the existing systems, both on site, and in the surrounding area.

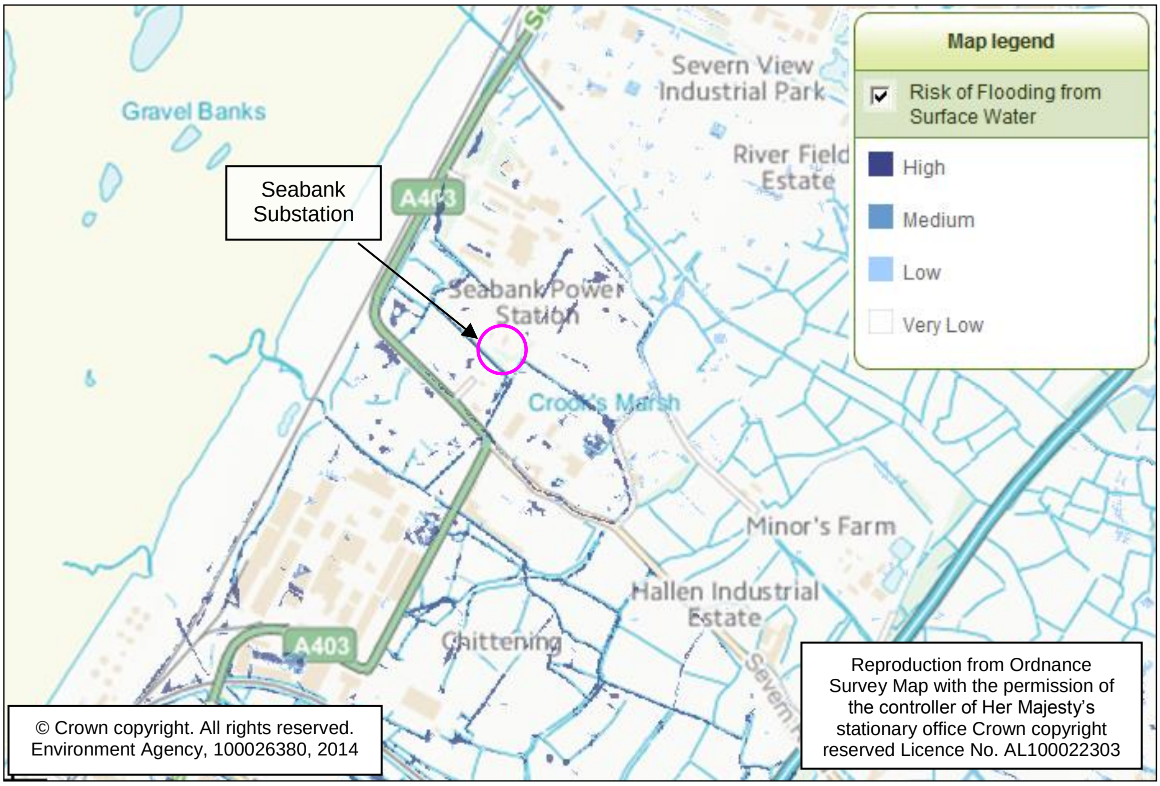
5.3.27 The Flood Map for Surface Water (FMfSW) shows surface water flood mapping undertaken at a national level to provide an indication of those areas potentially vulnerable to surface water flooding based on the 1 in 30 (3.3%) and 1 in 100 (1%) annual probability rainfall events. The area around the Seabank Substation is shown in **Inset 5.13**. This shows that the site is at low risk of flooding from surface water. However, the site is very flat and the FMfSW shows ponding areas in the vicinity of the site, although not specifically on the site. It is possible that a localised short duration extreme rainfall event might lead to some localised flooding. This is unlikely to be to a significant depth but there could be the possibility of 'nuisance' flooding and localised ponding to a shallow depth, less than 100mm. Any floor levels at ground level with access points with thresholds at ground level might suffer some minor flooding.

5.3.28 Bristol City Council's Preliminary Flood Risk Assessment (PFRA), June 2011 (Ref 5.15) classified the Seabank area (a 1km^2 grid square) as an area of "significant" surface water flood risk. However, this was based on national surface water flood risk mapping which has now been superseded by the FMfSW. The identification of the risk as "significant" was based on the presence of more than one critical service/infrastructure being affected.

5.3.29 None of the site has been identified by the Environment Agency to be within a critical drainage area.

5.3.30 The risk from surface water flooding is assessed as being **low,** although in extreme rainfall events there is risk of shallow ponding of water.

Inset 5.13: Environment Agency Flood Map for Surface Water



Groundwater Flooding

5.3.31 The Environment Agency has no records of groundwater flooding in the area.

5.3.32 There are two SFRAs that cover the area. The Bristol City Council SFRA (Ref 5.16), which includes the Avonmouth area north west of Bristol notes that there are no recorded incidents of groundwater flooding in the Avonmouth area. The Avonmouth/Severnside SFRA (Ref 3.10), which is a joint SFRA covering the wider area of Bristol, South Gloucestershire and the Lower Severn notes that groundwater flooding is not a particular issue for the area in general.

5.3.33 At a national level, mapping has been prepared showing Areas Susceptible to Groundwater Flooding (AStGWF). Whilst the mapping for this is not included within Bristol City Council's Preliminary Flood Risk Assessment (June 2011), the SFRA notes that the AStGWF mapping does not highlight any areas at risk of groundwater flooding. Although this is a high level mapping that cannot be used in isolation for the assessment of local groundwater flood risk, the absence of a clear identified groundwater flood risk is backed up by the absence of any recorded groundwater flooding concerns in other related documents such as the SFRAs.

5.3.34 With regard to specific soil and ground conditions, the area is not important in terms of groundwater resources, as indicated by the designation of the superficial deposits as unproductive strata in terms of groundwater yield, and the bedrock as a "Secondary B" aquifer, implying predominantly lower permeability layers. Related to this, the site is not identified by the Environment Agency as being located within a source protection zone. There are no known groundwater abstraction licences within 1000m of the site.

5.3.35 Given the geology of the area and the lack of evidence of any groundwater flooding records, it is concluded that any changes in groundwater level would be relatively slow due to the low permeability of the underlying soils.

5.3.36 The risk from groundwater flooding is assessed as being low.

Sewer Flooding

5.3.37 National Grid hold records of the drainage for the existing Seabank Substation. The record drawing (Drawing no. 12/18629 in **Volume 5.23.4.2, Appendix B**) indicates that the site is served by separate drainage systems for foul and surface water which upon leaving the site enters the power station's drainage system.

5.3.38 Currently, all surface water runoff from the GIS substation building and its annex, super grid transformer (SGT) buildings and its coolers, tanker and concrete hard standing areas drain to the surface water system via drainage channels and pipes. There are oil containment measures and oil separators in place to prevent pollution, and to capture pollutants before leaving the site. The water is collected in a sump and pumped via a rising main on the western edge of the site discharging to the adjacent surface water system which serves the wider area.

5.3.39 Neither of the SFRAs covering the area nor the PFRA give any indication that sewer flooding from sewers and drains outside of the site is a concern in the area.

5.3.40 The risk of sewer flooding is assessed as being **low.**

Flooding from Reservoirs and other Artificial Sources

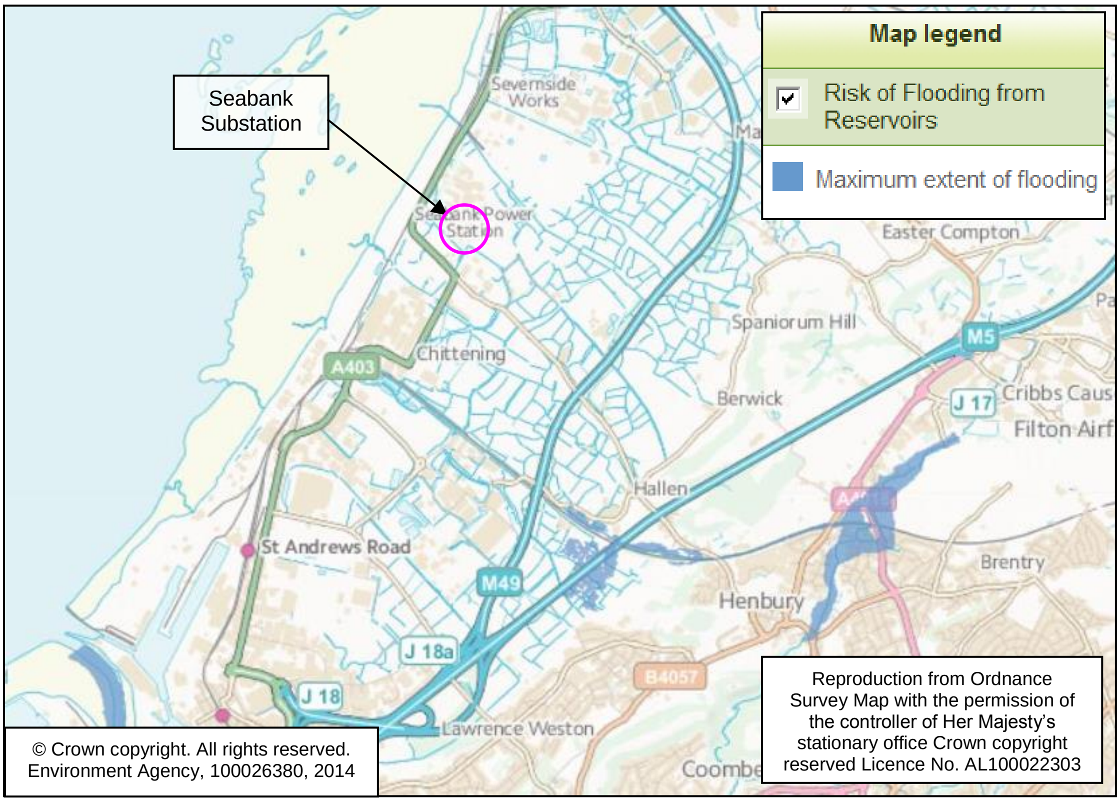
5.3.41 Flooding from artificial sources includes reservoirs, canals and lakes where water is retained above the natural ground level. The flood inundation map which indicates areas at risk in the unlikely event of failure of any reservoir is shown in **Inset 5.14**. The mapping indicates that the site is not at risk of flooding from reservoirs.

5.3.42 There are no canals in the local area and hence no risk of flooding from this source.

5.3.43 The risk of flooding from a burst water main in the area is low. Any burst would preferentially drain into the existing land drainage and surface water drainage systems. Although the site is flat, it not in a depression, so there is no risk of ponding at the site from this source.

5.3.44 The risk of flooding from reservoirs, canals or other artificial sources is low.

Inset 5.14: Reservoir Inundation Flood Risk Mapping



5.4 Flood Risk – Wider Context

<u>Core Strategy</u>

5.4.1 Within Bristol City Council's Core Strategy published in June 2011 (Ref 3.8), Policy BCS4 has identified Avonmouth as a priority area for industrial and warehousing development and renewal. Its economic strengths will be supported whilst protecting its environmental assets and acknowledging its development constraints.

5.4.2 The Core Strategy, Policy BCS13 also refers to addressing the challenges of climate change. A key outcome of this objective is "*development should contribute to both mitigating and adapting to climate change, and to meeting targets to reduce carbon dioxide emissions*". New development should demonstrate through Sustainability Statements of how to contribute to this climate change aspect.

5.4.3 In term of vulnerability to flood risk, Policy BCS16 sets out the requirements of the Sequential Test for applicants which are consistent with the PPG on Flood Risk and Coastal Change. Priority should be given to the development of sites with the lowest risk of flooding. With reference to the Core Strategy, development in areas at risk of flooding are expected to be resilient to flooding, incorporated sensitively designed mitigation measures.

Strategic Flood Risk Assessments

5.4.4 Bristol City Council, South Gloucestershire Council and the Lower Severn Internal Drainage Board have published a Level 1 (2007) (Ref 5.17) and Level 2 (2011) (Ref 3.10) SFRA for the Avonmouth/Severnside area. The Level 2 SFRA considered a range of flooding mechanisms covering fluvial flooding from the network of rhynes in the area, tidal flooding, and an assessment of tidal defence breach hazard.

5.4.5 The broad overall conclusions from the Level 2 SFRA are that for the area under consideration, defined within the SFRA as “Strategic Zone 4: Crook’s Marsh (Employment)” tidal flooding is the most significant risk. This is demonstrated through a series of fluvial and tidal flood risk models. The key results of this study with specific regard to the flood risk analysis are discussed in section 5.2.

5.4.6 With the residual tidal flood risk, which shows overtopping of defences in a 1 in 1,000 (0.1%) annual probability event, strategic mitigation measures are required. The Level 2 SFRA notes that these measures should seek to achieve the following key objectives relevant to the Seabank site:

- safe access and egress in the event of failure or a breach in the defences;
- safe refuge, as floods (especially through breach) may occur rapidly with little warning; and
- maintain operation of critical infrastructure during a flood.

5.4.7 In addition to the Avonmouth/Severnside SFRA, Bristol City Council has also published Level 1 (Ref 5.16) and Level 2 (Ref 5.18) SFRAs (2009) for the City of Bristol, which includes the study area. Within the Level 2 SFRA, the site is defined within “Area E: Avonmouth” which identifies that a key flood risk management measure for the area is to improve the tidal defences for the area.

Preliminary Flood Risk Assessment

5.4.8 The preparation of a Preliminary Flood Risk Assessment is a requirement of every Lead Local Flood Authority (LLFA) as defined under the Flood and Water Management Act (FWM Act) 2010. For the substation site the LLFA responsible for the preparing the PFRA is Bristol City Council, who published their PFRA in June 2011 (Ref 5.15).

5.4.9 The PFRA is a high level overview of flood risk attributable to surface water, groundwater, ordinary watercourses, sewers, reservoirs, canals, and other artificial sources. It draws together a wide range of readily available information as a means to inform the strategic overview of flood risk across the city.

5.4.10 This overview of flood risk, including mapping of various flood sources, is a valuable source of data to inform flood risk at the substation site. Within the context of this FRA, the PFRA is referred to with regard to various sources of flooding in section 5.2 where applicable.

Severn Estuary Shoreline Management Plan

5.4.11 The Severn Estuary Shoreline Management Plan (SMP) (Ref 5.19) published in 2000 details the preferred options for managing flood risk in the Severn Estuary.

5.4.12 ‘Hold the line’ is currently the preferred strategic option for the frontage. ‘Monitoring and research of coastal processes’ on the foreshore are recommended to investigate the implications of this strategy in the longer term. The Severn Estuary Shoreline Management Plan Review (SMP2) (Ref 5.20) completed in December 2010 indicated that there is no change to the above ‘hold the line’ strategy.

Severn Tidal Tributaries Catchment Flood Management Plan

5.4.13 The Catchment Flood Management Plan (CFMP) (Ref 5.21) for the Severn Tidal Tributaries provides an overview of flood risk management in the catchment for the next 100 years. The CFMP is intended to guide investment and flood risk management in the catchment carried out by the Environment Agency and other bodies with flood risk management responsibilities and powers.

5.4.14 The catchment is split into eight sub-areas of which sub-area 8, Avonmouth and Severnside, covers the Seabank site. The Environment Agency has adopted Policy Option 4 for this sub-area. This policy option is summarised as: “Take further action to sustain the current level of flood risk into the future (responding to the potential increases in risk from urban development, land use change and climate change)”. This policy option recognises that areas of low, moderate or high flood risk where the Environment Agency is already managing the flood risk effectively may need further actions to keep pace with climate change. Implementation of Policy Option 4 in the area would mean that the risk of flooding in 100 years would be the same as it is now.

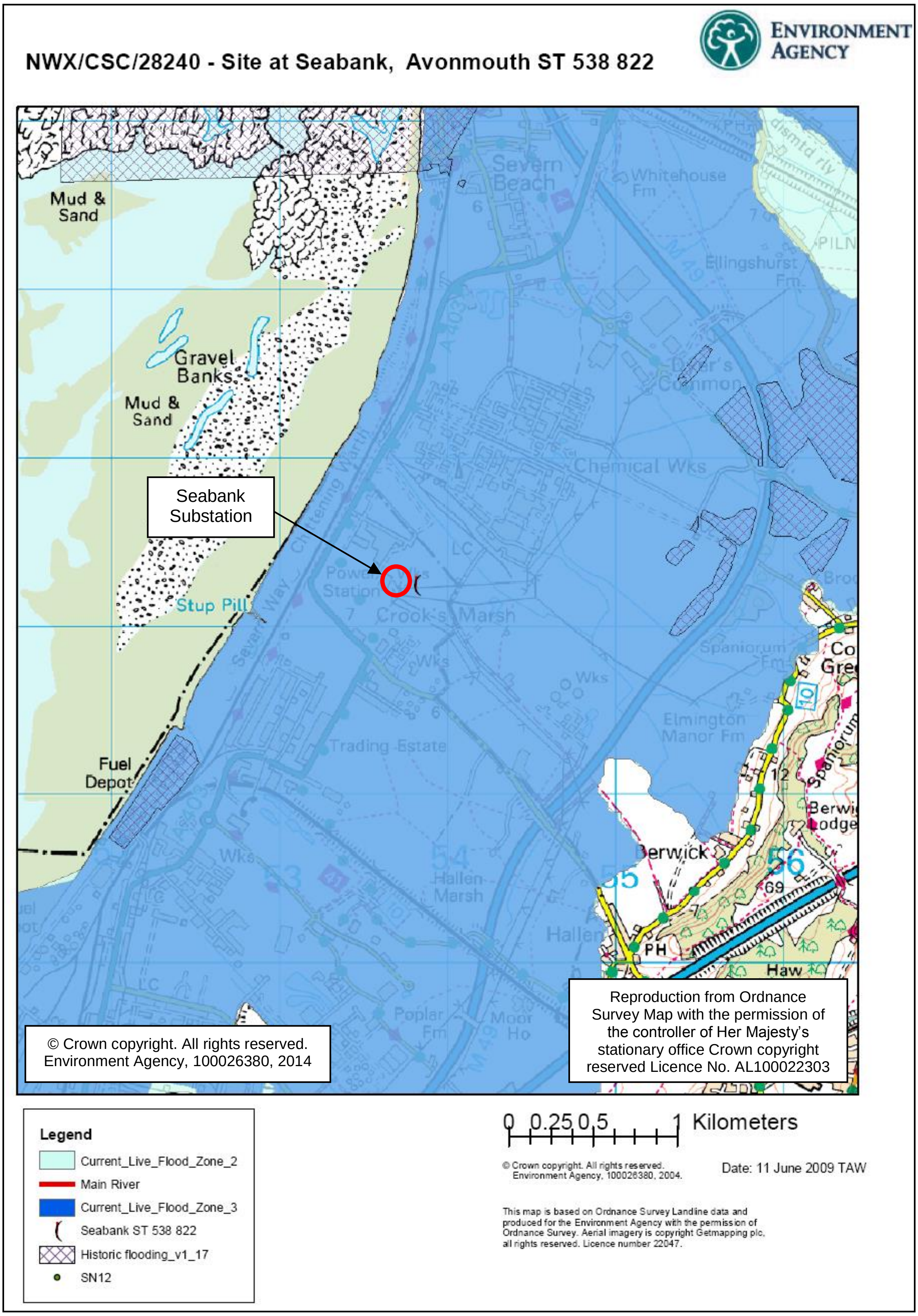
Evidence from Historic Flooding

5.4.15 The Environment Agency and Bristol City Council have no record of flooding at the site. Data from the Environment Agency shows historic flooding in the surrounding area, as shown in **Inset 5.15**.

5.4.16 The SFRAs and PFRA covering the area draw together historic flooding events from a range of sources. None of these indicate that there are any records of floods in the immediate vicinity of the site.

5.4.17 The Environment Agency historic records indicate that the Avonmouth area has previously suffered from tidal flooding on 13 December 1981. The Environment Agency report “Somerset and the Sea – the 1981 Storm 25 years on” (Ref 5.22), the actual tide level recorded at Avonmouth was 8.83mAOD, with a 1.7m surge. During this event high spring tides combined with storm force westerly winds resulting in overtopping of defences.

Inset 5.15: Historic Flood Mapping



Summary of Policy Context

5.4.18 The above strategies and plans that will shape flood risk management activities in the area strongly indicate that the area under consideration will continue to be protected over the coming decades, although the precise means by which this will be achieved, and the timing of different interventions, is not yet certain.

5.4.19 Within this wider flood risk management framework it is reasonable to conclude that the flood risk posed at the substation is likely to remain broadly similar to the present flood risk, even taking account of climate change impacts through increased fluvial flows and increased sea levels.

5.4.20 Despite this wider flood risk context for the development, from a FRA perspective it cannot be assumed that these strategies and plans will continue over the full lifetime of the substation. Therefore, suitable mitigation measures need to be considered for the site.

5.4.21 The evidence base gathered related to existing flooding problems, plans and strategies indicates that the main flood risk is from tidal sources. With the current defended situation for the site and surrounding area, the tidal flood risk is linked to both the potential for breach of the existing defences, or overtopping.

6. CLIMATE CHANGE

6.1 Introduction

6.1.1 This section considers climate change impacts (section 6.2), focused on sea level rise, increased river flows and increased rainfall intensities, covering the period to 2060. Consideration is also given to continued operation at the site beyond 2060, and the sensitivity of the proposed works at the site to an extreme climate change scenario (section 6.3).

6.2 Climate Change Impacts

6.2.1 Within the context of the existing flood risk at the substation, and the requirements of the National Policy Statements for Energy (specifically EN-1 and EN-5), climate change impacts from different flood sources have been considered alongside the present day scenario within section 5 using UKCP09 climate projections (Ref 5.12). By way of summary, the principal climate change impacts potentially affecting the site are:

- sea level rise affecting tidal flood risk;
- increase in fluvial flood flows; and
- increase in rainfall intensity affecting pluvial/surface water flood risk.

6.2.2 The consideration of climate change impacts also meets the requirements set out in the UK Climate Change Risk Assessment: Government Report (Defra, January 2012) (Ref 6.23) which are consistent with the requirements of the NPS and UKCP09 climate projections.

<u>Sea Level Rise</u>

6.2.3 The operational design life of the substation is 40 years. However, at the end of the proposed operational life it is possible that the site may still be required as part of the inter-connected grid at which point significant asset replacement would be required.

6.2.4 The SFRA modelling (from which the mapping outputs are derived for both the 2011 SFRA and the update in 2013) used sea level rise allowances in accordance with Defra guidance (Flood & Coastal Defence Appraisal Guide FCDPAG3 Economic Appraisal, Supplementary Note to Operating Authorities - Climate Change Impact, October 2006) (Ref 6.24). Although this guidance is now superseded, the total sea level rise allowance from 2020 to 2060 is very similar to the latest guidance being only 10mm higher compared to current guidance, and therefore the analysis remains valid.

6.2.5 Using current sea level rise guidance, an allowance has been made in accordance with the UKCP09 projections using the “upper end estimate” as defined in Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities (Environment Agency, 2011) (Ref 5.13). This approach meets the requirements for the climate change assessment identified within the EN-1 National Policy Statement for Energy (DECC, 2011). This upper end estimate represents the Inter-governmental Panel on Climate Change (IPCC) (Ref 6.25) high emissions scenario (referred to as the SRES A1FI scenario as defined in the IPCC Special Report on Emissions Scenarios) at the 95th percentile confidence limit.

6.2.6 The sea level rise allowances included for the UKCP09 upper end estimates are 4mm per year up to 2025, 7mm per year from 2026 to 2050, and 11mm per year from 2051 to 2080. This gives a total rise of 353mm from 2008 (the base date for the “Coastal Flood Boundary Conditions for UK Mainland and Islands” report) to 2060 which would be the anticipated end of operational life of the substation. In the event that the site continues to be used for a further 20 years to around 2080, this would give an additional rise of 220mm, giving a total rise of 525mm from 2020 to 2080.

6.2.7 The worst case scenario of the flood depths from the SFRAs was used in deriving the design flood level for the site. A comparison of the SFRA model outputs and UKCP09 results is shown in **Table 6.1**.

Table 6.1 Comparison of Sea Level Rise Impacts at the Site

Year	**SFRA Results**		**UKCP09 Results**
	Max Flood Depth (mm)	**Difference in Depth (mm)**	**Overall CC Allowance (mm)**
2010	250 - 500	0 (base year)	0 (base year)
2060	-	-	345
2073	1000 - 1500	500 - 1000	488
2110	1500 - 2000	1000 - 1500	1015

6.2.8 The SFRA results show that by 2073, the increase in maximum depth at the site is between 0.5m and 1.0m higher than the maximum depth (0.5m) in 2010. By contrast, sea level rise from 2010 to 2073 is only 488mm based on the UKCP09 projections using the upper end estimate.

Increased Fluvial Flows

6.2.9 The increase in fluvial flows has been included within the assessment of fluvial flood risk from the network of rhynes in the surrounding area. This has been drawn directly from the outputs of existing models in the Avonmouth/Severnside SFRA, which included consideration of climate change over 100 years from 2010 to 2110. This shows that at the extreme events being considered, up to the 1 in 1,000 (0.1%) annual probability fluvial flood event with a 1 in 2 (50%) annual probability tide level, that the site is not at risk of fluvial flooding.

Increased Rainfall Intensity

6.2.10 For the surface water runoff assessment, the site layout proposed has a net reduction in impermeable area. This would reduce the risk of flooding from surface water from that at present. Taking account of climate change, an allowance of 10% increase in the rainfall intensity values for the period 2040 to 2069 is recommended to account for the impact of climate change in accordance with Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities (Environment Agency, 2011), which specifically references UKCP09 projections. This increase would apply at the end of the operational life of the substation at around 2060. It is anticipated that this small increase in rainfall could be accommodated within the site area as it would infiltrate into the permeable surfaces within the site.

6.3 Sensitivity to Extreme Climate Change Scenario

6.3.1 Within the UKCP09 projections, set in the context of NPS requirements in EN-1, consideration is given to the most extreme UKCP09 climate change scenario, referred to as the H++ scenario.

6.3.2 The H++ scenario provides an estimate of sea level rise and river flood flow change beyond the likely range but within physical plausibility. It is useful for contingency planning to understand what might be required if climate change were to happen much more rapidly than expected.

6.3.3 For the existing substation and the proposed modifications and extension to it, it is the tidal flood risk associated with sea level rise that would have the biggest overall impact. Adaptive measures in the future would be driven by a combination of actual climate change and future flood and coastal risk management strategies and policies for the area, particularly with regard to the tidal defences that protect Avonmouth and the area northwards towards Severn Beach.

6.3.4 However, taking the H++ scenario gives an extreme tide level 325mm higher than the UKCP09 High emissions, 95th percentile value by 2060. For the substation at Seabank, at the end of the proposed operational life of the substation at around 2060, the proposed flood defences for the site (described in section 7) would remain slightly above the H++ scenario extreme tide water level. The design of the flood defence measures at the site also allow for future adaptation beyond 2060 in the event that the H++ scenario is realised and the site is still required beyond 2060. These future adaptive measures would also be shaped by the flood and coastal risk management policies in place at that time.

7. FLOOD RISK MANAGEMENT MEASURES

7.1 Introduction

7.1.1 This section describes the flood risk management measures proposed for the site focused on the key flood risks to the site (sections 7.2 and 7.3). Access and egress to and from the site (section 7.4) and flood warning and emergency evacuation are also considered (section 7.5). Residual risk to the site and the impact resulting from the substation is considered (sections 7.6 and 7.7). The existing flood defences which provide flood protection to the site are identified (section 7.8). Finally, this section summarises how the Sequential and Exception Tests are met (section 7.9).

7.2 Tidal Flooding

7.2.1 Within section 5, tidal flood risk is identified as the principal flood risk for the substation. In the defended situation i.e. with protection provided by the Severn Estuary flood banks, the flood risk remains high even at present, with a maximum flood depth at the site of up to around 0.25m in the 1 in 200 (0.5%) annual probability event, or up to 0.5m in the 1 in 1,000 (0.1%) annual probability event, primarily associated with flood bank overtopping risk. Flood depths at the site at the end of the design life around 2060 during the 1 in 1000 (0.1%) annual probability event could be up to 1.25m. For this future case, this equates to an estimated level of around 7.65mAOD.

7.2.2 In the undefended situation, assuming no protection is provided by the tidal flood banks along the Severn Estuary, flood depths at the site would be greater, with the extreme tide level for the 1 in 1,000 (0.1%) annual probability event being around 9.7mAOD, approximately 3.2m above typical the ground level at the site.

7.2.3 National Grid's flood mitigation policy is to protect up to the 1 in 1,000 (0.1%) annual probability event where possible. For this development, this level would be 6.90mAOD (6.40mAOD + 0.5m flood depth) at present, rising to 7.65mAOD (6.40mAOD + 1.25m) at the end of the design life of the development at 40 years with the existing flood defences along the Severn Estuary remaining in place i.e. the defended situation.

7.2.4 The wider flood risk policies affecting the area suggest that in the short, medium and long term, flood risk will continue to be managed to maintain the current level of risk. However, whilst these policies cannot be relied upon to continue to be implemented over the lifetime of the development, if the existing defences were severely impacted due to the lack of maintenance (due to policy changes) a vast area from Avonmouth 3km to the south stretching several kilometres to the north would become at considerably higher risk of flooding. It is therefore considered over conservative in this instance to design for a 1 in 1,000 (0.1%) annual probability event for the undefended situation i.e. flood defences along the Seven Estuary do not remain as they are at present, given this wider development context for the area.

7.2.5 It is therefore proposed that the design standard for the Seabank site is the 1 in 1,000 (0.1%) annual probability event (consistent with National Grid Flood Mitigation Policy) for the 'defended' situation. This gives a design flood level at the site of 7.65mAOD at the end of the design life, taking account of climate change. It is recommended to include a 400mm freeboard allowance giving a design flood defence level at the site of 8.05mAOD to allow the substation to remain operational during the 1 in 1,000 (0.1%) annual probability event.

7.2.6 Various options have been considered for flood risk mitigation at the site, taking account of existing infrastructure on the substation site. These include measures such as:

- Flood defence walls around specific items of critical equipment located around the site. This includes transformers and other related equipment.
- Flood proofing, including flood gates at access points, to the main GIS and associated infrastructure building, and sealing of ducts and other entry points.
- Raising critical equipment above the design flood level.

7.2.7 A review of these possibilities based on site observations, operational considerations and feasibility concluded that:

- Localised defences around specific pieces of equipment, or in some cases localised raising of critical equipment, would be feasible, but would only be appropriate if there was a means to protect other existing infrastructure, particularly equipment located within the GIS and associated infrastructure building which would be vulnerable to even relatively shallow flood depths i.e. more than 100mm.

- Preventing water entry into the GIS and associated infrastructure building would be very difficult and full protection could not be guaranteed due to the numerous and complex entry points including those for cabling and other services. Flood proofing and possible strengthening of existing walls and maintenance of access points could also be difficult.

- Significant critical equipment is located at a level of around 6.8mAOD within the GIS hall and associated buildings. The nature of this equipment and the various cable connections make it technically not feasible to raise the equipment above the design flood level.

7.2.8 It is therefore concluded that the preferred measure to be taken at the site to mitigate flood risk would be to build a perimeter flood defence wall along the site boundary with flood gates at the site entrance. The minimum proposed finished level for the perimeter flood defence wall is 8.05mAOD, approximately 1.65m above the lowest ground level (approximately 6.40mAOD) on the site. This level is 1.15m above the present 1 in 1000 (0.1%) annual probability event level of 6.90mAOD, and 400mm above the 1 in 1000 (0.1%) annual probability event level of 7.65mAOD at the end of the design life of 40 years at around 2060, taking account of sea level rise. This option, as well as protecting the extension to the site and therefore the proposed new connection to the transmission system, would also provide resilience to the existing substation equipment that connects both the Seabank power station and the adjacent WPD 132kV substation.

7.2.9 To test the sensitivity of the proposed flood defences to climate change, the H++ scenario is considered, giving an additional 325mm for sea level rise. This would give a design flood level of 7.98mAOD (7.65mAOD + 0.325m) which is marginally below the flood defence wall design level of 8.05mAOD.

7.2.10 This measure would also be adequate to address any minor residual risk from fluvial flooding (and other sources of flooding). Within the substation area, it is anticipated that the existing pumped drainage system would operate to deal with potential surface water runoff within the 'enclosed' site compound when the flood gates are closed. This pump capacity would be confirmed at detailed design stage.

7.2.11 Consideration has also been given to determination of the tidal flood water displaced by the proposed perimeter flood defence wall. It is estimated that approximately 17,000m^3 of water would be displaced with a flood level up to the top of the flood defence. This represents the 1 in 1000 (0.1%) annual probability flood level at the end of the operational life of the substation, including the 400mm freeboard. Taking the 'at risk' area from the railway line north of the M49 as far as the Avonmouth area, it is estimated that this displaced volume would equate to an increase in flood level of less than 1mm for the 2055 design scenario. This extremely small change in flood depth would not result in any perceptible change in flood risk elsewhere and hence would not warrant any compensatory storage. Additionally, the presence of the flood wall would not locally affect flood levels elsewhere, as the site is not on a defined flow path – the entire site would be surrounded by water.

7.2.12 The proposed operational life of the substation is 40 years although Hinkley Point C Power Station would be likely to generate power for an estimated 60 years. Therefore, consideration is given to operation for a further 20 years. This would give an estimated flood level of approximately 7.90mAOD (6.4mAOD + 1.5m maximum flood depth) at 2073 based on the SFRA (2013) flood mapping. This compares well to the estimated level of 7.87mAOD for 2080, based on and interpolation between the flood depths from the 2010 and 2110 flood mapping. The design level for the flood defences at the site at 8.05mAOD is approximately 150mm above these levels, and therefore, the site would continue to be protected, but with reduced freeboard. However, during the operational life of the substation, the required defence level would be reviewed, taking into consideration actual sea level rise and flood risk management strategies in place at that time. This approach is consistent with a managed adaptive response to climate change.

7.2.13 The design of the flood defence wall with a defence height of 8.05mAOD would also allow for future raising depending on actual sea level rise and other (future) flood defences protecting the area. This is consistent with the precautionary principle such that the currently proposed works do not restrict future adaptation measures.

7.3 Overland Flow and Surface Water

7.3.1 The proposed development is located on a very flat of land at approximately 6.6mAOD (on average). The area to the east of the site is slightly higher with levels ranging from 7.0 to 11.0mAOD. There is potential that surface water runoff from the adjacent land to the east would flow towards the substation site. As noted in section 5, the risk of surface water flooding is very low. The proposed perimeter flood wall would protect the site against the risk of surface water flooding from overland flow from this general location. However, as noted above, the measures taken to protect against tidal flooding would be more than adequate for any minor residual flood risk from this source.

7.4 Access and Egress for Operation and Maintenance

7.4.1 Access to and egress from the site is via the A403, located approximately 350m to the west of the site which is within Flood Zone 3 along with all the other roads in the area. An Ordnance Survey map spot level on the A403 in the vicinity of the proposed area indicates a level of 9.4mAOD.

7.4.2 The site would generally be unmanned with access only required for maintenance and routine inspections. The flood gates at the site access would normally be closed to provide full protection. Given that flood risk at the site is most likely from extreme tides leading to overtopping of tidal defences, there would be advance warning of possible flood risk and overtopping risk.

7.4.3 The execution of maintenance operations can therefore be planned to take account of adjacent river levels, forecast tides and prevailing weather conditions. With the flood wall around the site and the flood gates closed, the substation would operate effectively during flood events and therefore, no access during flood events would be necessary.

7.4.4 In the unlikely event that personnel were on site at the onset of flooding, egress from the site compound would be initially immediately to the west and northwest along the site access road for Seabank Power Station to the A403 and then to the M49 (heading south) or M48 (heading north). The closest high ground along this route is around 8km away towards Aust village, along the M48 located to the north east of the site. However, egress from here would pass through an area at higher flood risk along the A403 at Redwick. Alternative egress would be towards Avonmouth via the A403 located approximately 3.5km south of the site. At this location, the high ground would provide a temporary refuge area until flood waters subsided. Operating procedures would have to ensure that temporary opening of the flood gate for vehicle egress would not compromise flood protection for the site. In the event that egress from the site by vehicle is not feasible, the slightly higher ground located immediately adjacent to the east of the site (at the landfill site) may be accessed on foot as a temporary emergency refuge area.

7.4.5 Within the Avonmouth/Severnside SFRA for this area (Strategic Zone 4) it is specifically noted that new, improved access routes would be essential for safe access and egress during wave overtopping and breach events. However, it also notes that the effect of raising access routes to remain usable during a breach situation on flooding elsewhere would need to be carefully considered.

7.4.6 Given the potentially extensive and long travel time required to reach high ground, it is anticipated that it would be necessary to liaise with the emergency services and the Local Authority's emergency planning function to agree a safe evacuation procedure. During a flood event there may be many people requiring evacuation from the surrounding area. Consequently it may be necessary to provide a refuge area where people could wait until rescue is available. With the proposed perimeter flood defence wall, the site compound could be used as a refuge area for site personnel. It is understood that all National Grid sites that are at flood risk, such as Seabank, have an agreed plan in place to manage safety of the site and personnel should there be a flood event.

7.5 Flood Warning and Escape and Evacuation

7.5.1 For the proposed substation site, the minimum site level of 6.40mAOD is significantly below the predicted 1 in 1,000 (0.1%) annual probability event flood level of around 7.65mAOD (defended) in 2060.

7.5.2 The site lies within an area designated to receive a Flood Warning in the event that a flood is likely to occur. It is recommended that, National Grid, as the operator of the substation, is signed up to the Floodline Warnings Direct Service provided by the Environment Agency so that adequate action could be taken to evacuate the site if necessary. Any warning would be useful to inform of the possible need for a post-flood inspection.

7.5.3 As flood warnings can be provided by phone, text or email, and the site would generally be unmanned, arrangements should be made so that the warnings are issued to a suitable National Grid operations centre in order for personnel to take action accordingly in response to the warning.

7.5.4 If evacuation is required the normal evacuation route would be via the A403 initially as discussed in the previous section. Evacuation routes to the north or to the south should be considered, depending on the actual flood conditions.

7.6 Residual Risk

7.6.1 The measures outlined above to address flood risk at the substation, both for the existing equipment and the new works, gives a high level of flood resilience to enable the substation to remain operational during flood events. For flood events over the design event there remains a low residual risk. This is addressed through the allowances for freeboard and climate change, flood warning measures, and evacuation procedures. Additionally, as residual risk effectively increases as climate change impacts become apparent through the operational life of the works, residual risk would be managed through additional adaptive measures as necessary.

7.6.2 In the event of an over design event overwhelming the defences at the site, the pumping and drainage arrangement at the site would offer a further minor contribution to managing the residual flood risk. Once the capacity of this system was exceeded and water entered the main buildings, damage to the substation would result. Prior to this occurring, under these emergency conditions the substation could be shut down remotely.

7.7 Potential Impact on Flooding Elsewhere

Surface Water Runoff

7.7.1 The modifications to the site associated with the removal of some existing equipment, and the addition of new works results in a net reduction in impermeable area as noted in section 4.1. This would result in a reduction in surface water runoff generated at the site.

7.7.2 The site drainage currently discharges to a drainage ditch outside of the site compound, which subsequently discharges into the network of rhynes managed by the Lower Severn IDB. With the net increase in permeable area, the discharge rates and runoff volumes to the rhynes would be reduced. This provides betterment compared to the current situation with less runoff discharging to the rhynes.

7.7.3 For the specific items of equipment located on new areas of hard standing, runoff from these impermeable surfaces would flow directly off the hard standing to the adjacent ground where it would infiltrate through the gravel into the soil below. In effect there would be little, if any, change to the present situation. In the event that the land is already saturated, there would be no difference between the ground being permeable or impermeable.

7.7.4 The main means by which this overall betterment is provided is to ensure that the gravelled areas readily allow water to infiltrate through the gravel as part of the underlying SuDS approach for the site. The selected gravel material would be such that it is large enough and sufficiently uniform to ensure that it is freely draining to the soil (or made ground) below. This approach meets the sustainable drainage requirements set out in the draft National Standards on drainage under the Flood and Water Management Act 2010.

Water Quality Pollution

7.7.5 The substation already includes oil containing equipment such as transformers, which, by their presence, gives the possibility of pollution incidents due to oil leakage. However, to prevent such an occurrence, there are existing oil containment measures and oil separators at the site, connected to the surface water drainage system. These elements of the development will remain in place, and specific National Grid procedures on managing pollution on site would continue to be implemented to prevent any incident.

7.8 Flood Defences

7.8.1 **Volume 5.23.4.2, Appendix D** shows the existing flood defences at the Seabank site along the Severn Estuary, forming an extensive line of tidal flood defences. The lowest level noted is at 9.10mAOD at “Map Ref. 12” shown in the NFCDD Defence Information map in **Volume 5.23.4.2, Appendix D**. This is located approximately 1.3km to the south west of the site. For the defences closest to the site along a 1km length between “Map ref. 1” and “Map ref. 5” on the NFCDD Defence Information map (**Volume 5.23.4.2, Appendix D**), the lowest level is 9.33mAOD at “Map ref. 8”.

7.8.2 The condition of the defences was assessed by the Environment Agency as “fair” and “good” based on inspections from 2007 to 2010.

7.8.3 The site would not affect any flood defence maintenance activities by others due to the distance from them.

7.9 Application of Sequential and Exception Tests

7.9.1 Sections 3.4 and 3.5 set out the requirements of the Sequential and Exception Tests. This section summarises how these tests have been met. The wider consideration of the Sequential Test for the Proposed Development as a whole is included as an appendix to the Hinkley Point C Connection Route FRA (**Volume 5.23.5.2**).

7.9.2 With regard to the location of the substation in Flood Zone 3a, both the Sequential Test and Exception Test need to be passed for “Essential Infrastructure”.

7.9.3 For the Sequential Test, the analysis within the preceding sections has demonstrated that the substation could remain operational and safe in times of flood. This has taken specific account of:

- mitigation for tidal (and other) flood risk;
- access and egress for planned maintenance; and
- escape and evacuation routes.

7.9.4 Additionally, there are no other suitable sites at lower flood risk at which the proposed modifications could be located within the constraints of the existing transmission infrastructure.

7.9.5 **It is considered that the proposed modifications to Seabank Substation meet the requirements of the Sequential Test.**

7.9.6 For the Exception Test, the vulnerability of the site has been considered, and it has been demonstrated that the site would generally be unmanned, posing no risk to users. The nature of the tidal flood risk is such that there are likely to be forecasts and warnings of major storm surges in advance of the need to mobilise to the site, allowing maintenance to be scheduled around any potential flood conditions.

7.9.7 The layout and design of the site has been shown not to increase flood risk elsewhere.

7.9.8 The wider sustainability benefits are considered to outweigh the flood risk, as without the proposed modifications, within the context of the Hinkley Point C Connection Project, there would be insufficient transmission infrastructure in the region to enable a move towards a low-carbon economy.

7.9.9 **It is considered that the proposed modifications to Seabank Substation meet the requirements of the Exception Test.**

8. CONCLUSIONS

8.1.1 This FRA complies with the requirements set out in National Policy Statements, specifically Overarching Energy Policy (EN-1) and Electricity Networks Infrastructure Policy (EN-5) and demonstrates that flood risk from all sources has been considered for the entire Seabank Substation site.

8.1.2 The existing substation site lies in an area designated by the Environment Agency as Flood Zone 3. This means that the site has a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

8.1.3 The NPPF sets out a Sequential Test, which states that preference should be given to development located within Flood Zone 1. If there is no reasonably available site in Flood Zone 1, then built development can be located in Flood Zone 2. If there is no reasonably available site in Flood Zone 1 or 2, then nationally significant energy infrastructure projects such as the Hinkley Point C Connection project - classified as "Essential Infrastructure" - can be located in Flood Zone 3 subject to passing a series of criteria known as the Exception Test.

8.1.4 This FRA demonstrates that the requirements of both the Sequential Test and the Exception Test have been met.

8.1.5 This FRA has concluded that:

- There is a flood risk in the event of extreme tidal flood events, even with the presence of the existing flood defences along the Severn Estuary, due to the low lying nature of the site. The tidal flood risk, even under the current 'defended' situation (with the Severn Estuary tidal flood banks in place) is assessed as high with modelled flood depths at the site of up to 0.25m during the 1 in 200 (0.5%) annual probability event due to overtopping of the tidal defences. Allowing for climate change, this risk would increase significantly by the end of the lifetime of Seabank Substation based on overtopping and breach modelling undertaken as part of the Strategic Flood Risk Assessment for the area.

- There is a very high risk of flooding from extreme tidal events for the 'undefended' situation i.e. without the existing tidal defences. Various strategies and plans for the area indicate that in the short, medium and long term, flood risk will be managed to maintain the current level of flood risk, to keep pace with the impacts of climate change, primarily due to sea level rise. The economic activity in the area, including major industrial and other commercial activities, depend on the tidal defences being in place. However, continuation of these strategic options and policy approaches cannot be guaranteed as they depend on future funding being available. Seabank Substation on its own would therefore need to be resilient to flooding, taking account of both sea level rise and other factors such as policy changes.

- Flood risk from other sources (fluvial, surface water, groundwater, sewers, reservoirs and other artificial sources) is demonstrated to be low.

- The impact of the development on flood risk elsewhere is demonstrated to be low. There is a minor loss of tidal floodplain storage; however the local increase in water level is demonstrated to be less than 1mm and imperceptible in terms of any change in flood risk elsewhere. There is no increase in runoff volumes discharging to the local rhynes. Minor localised runoff from impermeable surfaces will infiltrate surrounding permeable surfaces and have no significant impact on existing flood risk.

- The estimated levels for the 1 in 200 (0.5%) and 1 in 1,000 (0.1%) annual probability flood events are around 6.65mAOD and 6.90mAOD respectively for the defended situation. With allowance for climate change and a design life of 40 years, the estimated flood levels for the 1 in 200 (0.5%) and 1 in 1,000 (0.1%) annual probability flood events are 7.28mAOD and 7.65mAOD respectively. The minimum proposed finished floor level of approximately 6.60mAOD is well below the 1 in 1,000 (0.1%) annual probability flood event with climate change. There is therefore a need to design the site layout to take account of the flood levels being higher than the ground level, by employing suitable mitigation measures for this flood risk.

- The primary measure proposed at the site to mitigate flood risk is to build a perimeter flood defence wall with flood gates at the entrance (these would normally be closed and only opened for intermittent access if there is no flood risk and it is safe to do so). The minimum proposed defence level of 8.05mAOD is 1.15m above the present 1 in 1000 (0.1%) annual probability event level of 6.90mAOD, and 400mm above the 1 in 1000 (0.1%) annual probability event level of 7.65mAOD at the end of the design life, taking account of sea level rise associated with climate change.

- The proposed operational life of the substation is 40 years although Hinkley Point C Power Station would be likely to generate power for an estimated 60 years. Therefore, consideration is given to operation for a further 20 years. This would give an estimated flood level of approximately 7.90mAOD. The design level for the flood defences at the site at 8.05mAOD is approximately 150mm above this level, and therefore, the site would continue to be protected to 2080. During the operational life of the substation, the required defence level would be reviewed, taking into consideration actual sea level rise and flood risk management strategies in place at that time. This approach is consistent with a managed adaptive response to climate change. The design of the flood defence wall would also allow for future raising, consistent with the precautionary principle such that the currently proposed works do not restrict future adaptation measures.

- This mitigation option also provides protection to the existing infrastructure at Seabank Substation, thereby building resilience for the entire substation site, which also connects to both the Seabank power station and the adjacent Western Power Distribution 132kV substation.

- National Grid's Flood Mitigation Policy is to protect up to the 1 in 1,000 (0.1%) annual probability event where possible. For this Seabank site, this level would be 6.90mAOD in 2014, rising to 7.65mAOD after around 40 years operation, with the existing flood defences along the Severn Estuary remaining in place i.e. the defended situation. The wider flood risk policies affecting the area suggest that in the short, medium and long term, flood risk will continue to be managed to maintain the current level of risk although continued implementation of these policies cannot be relied upon over the full lifetime of Seabank Substation. However, if the existing tidal defences on the Severn Estuary defences were severely impacted due to a lack of maintenance (for example, due to policy changes) a vast area from Avonmouth 3km to the south of Seabank, stretching several kilometres to the north, would become at considerably higher risk of flooding. It is therefore considered over conservative in this instance to design for a 1 in 1,000 (0.1%) annual probability event for the undefended situation.

- The measures proposed to address tidal flood risk at the site are also appropriate for other forms of flooding, although flood risk from other sources is significantly lower. The site currently has a drainage sump and pumping arrangement to deal with surface water at the site. This arrangement will continue and it is anticipated that this could deal with the potential surface water runoff trapped within the site compound following the construction of the perimeter flood defence wall, and with flood gates at the access point closed.

- The impact of climate change has been assessed using the latest UKCP09 projections. This covers the anticipated operational life of the substation to 2060, with measures proposed to take into account the impacts of climate change. In the event that the site is still required beyond 2060, there is additional adaptive capacity to address the potential future impacts of increased sea level rise, fluvial flows and rainfall intensity. Under the sensitivity testing to the H++ climate change scenario, the flood defences proposed for the site would allow the substation to remain operational during the 1 in 1,000 (0.1%) annual probability event in 2060.

- A safe access and egress plan should be included within the management plan to ensure that suitable arrangements are allowed for in the event of a flood which might affect area in the vicinity of the site. However, as the substation is an unmanned site it would be unusual for there to be any planned maintenance activities during a flood event. With the flood defence wall around the site and the flood gates kept in the closed position, the substation would operate effectively during flood events and therefore no access during flood events would be necessary.

- The site lies within an area designated to receive a Flood Warning in the event that a flood is likely to occur. For escape and evacuation, should any personnel be on site, it is recommended that the substation is signed up to the Floodline Warnings Direct Service provided by the Environment Agency so that adequate action could be taken to evacuate the site if necessary. It should however be noted that the substation site could also be used as a preferred place of refuge in the event that any operations staff are on site during flooding. This is linked primarily to the risk of flooding of access routes to the site, in the event that the site is manned at the onset of a flood event, and routes away from the site are impassable.

9. REFERENCES

1.1 National Grid. Need Case for the South West and the South Wales and Gloucestershire Regions. 2014.

1.2 Department of Energy and Climate Change. Overarching Energy Policy Statement for Energy (EN-1). July 2011.

1.3 Department of Energy and Climate Change. National Policy Statement for Electricity Networks Infrastructure (EN-5). July 2011.

1.4 DCLG. NPPF Planning Practice Guidance; Flood Risk and Coastal Change. March 2014. http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/

1.5 Department for Communities and Local Government (DGLG 2012a). National Planning Policy Framework (NPPF). March 2012.

2.6 Soil Survey of England and Wales. 1:250,000 Soils of England and Wales Sheet 5 South West England. 1983.

2.7 British Geological Society. Geological Map Sheet 250 (Chepstow). 1981.

3.8 Bristol City Council. Bristol Development Framework Core Strategy. Adopted June 2011.

3.9 National Grid. Hinkley Point C Connection Strategic Optioneering Report. December 2009.

3.10 Capita Symonds. Bristol City Council, South Gloucestershire Council and Lower Severn Drainage Board Avonmouth/Severnside Strategic Flood Risk Assessment Level 2 Technical Report Final. February 2011.

5.11 Environment Agency. Coastal Flood Boundary Conditions for UK Mainland and Islands. February, 2011.

5.12 Department for Environment, Flood and Rural Affairs (Defra) and Department for Energy and Climate Change (DECC). UK Climate Projections (UKCP09) Marine and Coastal Projections. 2009.

5.13 Environment Agency. Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities. 2011.

5.14 Arup. Avonmouth Severnside Strategic Flood Risk Assessment 2073. 2013.

5.15 JBA Consulting. Bristol City Council Preliminary Flood Risk Assessment – Preliminary Assessment Report. June 2011.

5.16 Halcrow. Bristol City Council Strategic Flood Risk Assessment Level 1 SFRA Final Report. March 2009.

5.17 Capita Symonds. Bristol City Council, South Gloucestershire Council and Lower Severn Drainage Board Avonmouth/Severnside Strategic Flood Risk Assessment Level 1 Summary Report. January 2007.

5.18 Halcrow. Bristol City Council Strategic Flood Risk Assessment Level 2 SFRA Main Report. November 2009.

5.19 Gifford Associated Consultants. The Severn Estuary Shoreline Management Plan – The Non-Technical Summary (SMP). December 2000.

5.20 Atkins. Severn Estuary Shoreline Management Plan Review (SMP2). December 2010.

5.21 Environment Agency. Severn Tidal Tributaries Catchment Flood Management Plan - Summary Report. December 2009.

5.22 Environment Agency. Somerset and the Sea – the 1981 Storm 25 years on.

6.23 Department for Environment, Flood and Rural Affairs (Defra). UK Climate Change Risk Assessment: Government Report. January 2012.

6.24 Department for Environment, Food and Rural Affairs. Flood and Coastal Defence Appraisal Guide FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities - Climate Change Impact. October 2006.

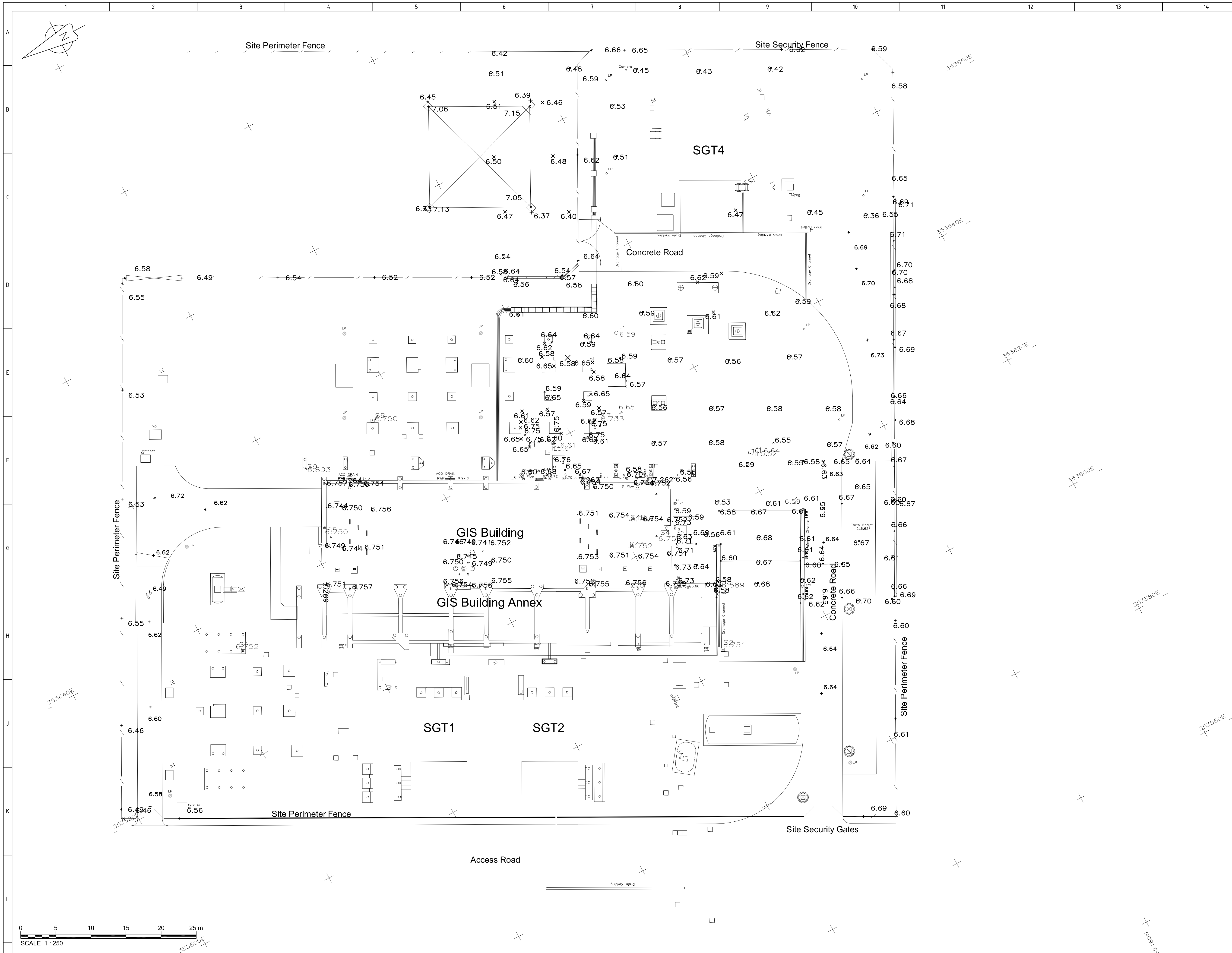
6.25 Intergovernmental Panel on Climate Change. IPCC Special Report on Emissions Scenarios Summary for Policymakers. 2000.

Appendix A – Inset 3.1 Preferred Route Corridor

Inset 3.1. Preferred Route Corridor

This map is based upon Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown copyright. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings. Licence No. 100024241 2011.

Appendix B – Seabank Substation Development Drawings



NOTES

1. All levels are in meters above Ordnance Datum.
2. Information taken from 'OnSite' Topographical / Drainage Layout drawing number P477070/1.

LEGEND

REFERENCE DRAWINGS

HOLDS

Rev	Rev. Date	Purpose of revision	Originator	Checker	Reviewer	Approver
P0	02.04.14	Issued with FRA	RIR	DC	SB	SB

PRELIMINARY

j2m

nationalgrid
Warwick Technology Park, Gallows Hill, Warwick, CV34 6DA

Drawing Title
SITE SURVEY

SEABANK 400kV GIS SUBSTATION

Site
SEABANK 132kV/400kV SUBSTATION

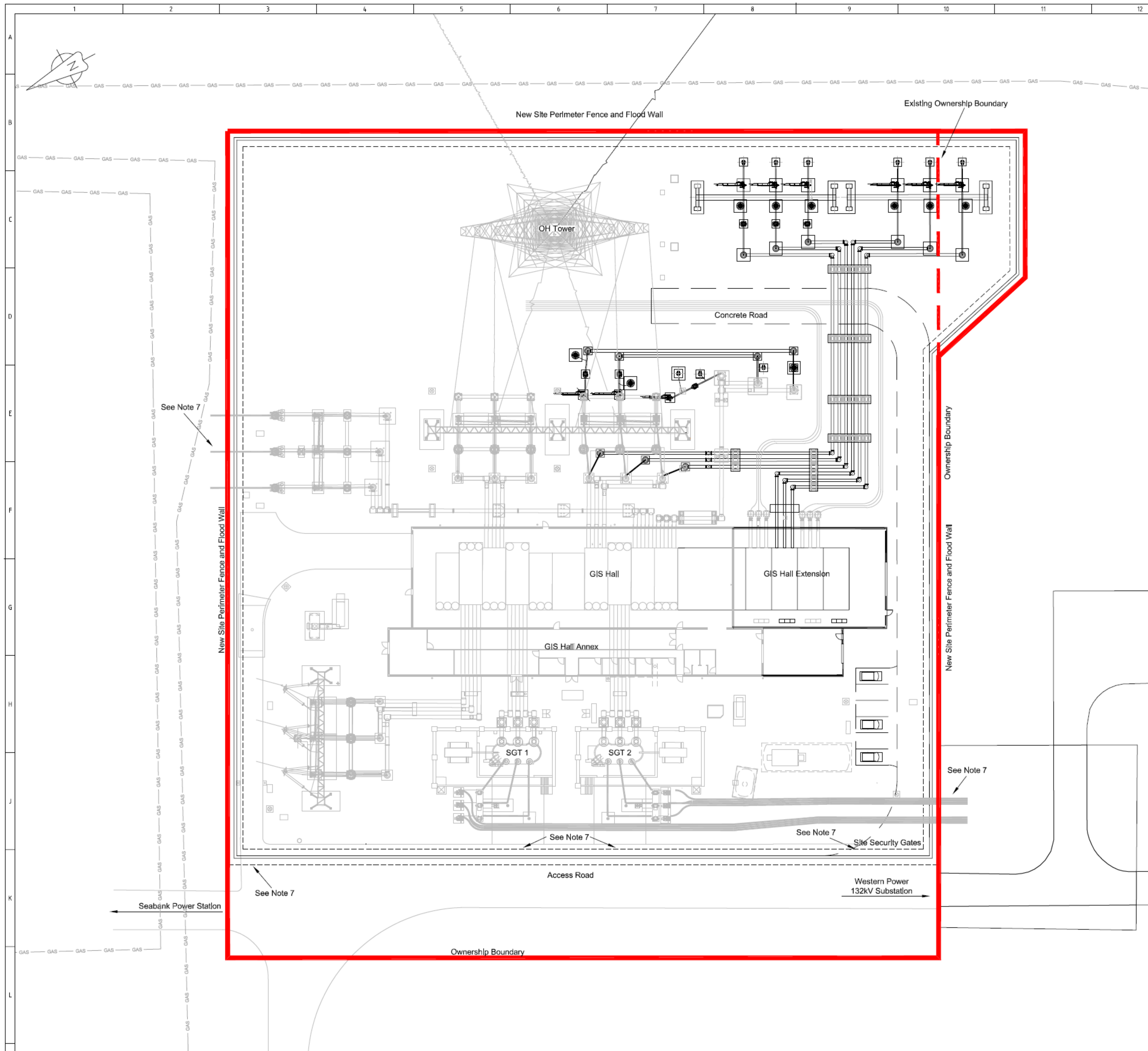
Scale	Sheet size	Sheet No.	Total Sheets.
1:250	A1	1	1

Originator Job No. B2916420

Drg No. 12/J2M/2046040 | Revision P0

N.G. Project No. 20898

Issue		Purpose of Revision	Issue		Purpose of Revision
Drawn		NG Issue Description to go in here when required	Drawn		
Checked			Checked		
Approved / Date			Approved / Date		



SHES Box
(Containing safety, health and environmental information)

In addition to the hazards and risks normally associated with constructing, maintaining and demolishing the structures on this drawing, the following significant risk information should be taken into account when planning and carrying out construction, maintenance and demolition work.

CONSTRUCTION
Construction works will require the use of the existing site access road which is oversailed by existing overhead conductors. Safety clearances must therefore be considered during construction and in the selection of plant.

Possible contamination of underlying ground. See ground investigation report X05842 for details.

Existing services and other underground structures (i.e. redundant foundations) may be present throughout the site. All groundworks including piling should proceed with caution with suitable control measures in place.

OPERATION

MAINTENANCE (Including cleaning)

DEMOLITION

NOTES

1. This drawing is for development purposes only.
2. All coordinates are in metres and relate to Ordnance Survey Datum.
3. All levels are in metres and relate to Ordnance Survey Datum (Newlyn).
4. Base plan of existing from Areva Substation Earthing Layout (Dwg. No. 25/4482).
5. All foundation sizes shown indicatively.
6. All dimensions are in millimetres unless otherwise noted.
7. Details of flood wall at substation access points, transformer skidways, and HV cable entries to be confirmed.

LEGEND

Proposed Plant
Proposed Vehicle Access Road

REFERENCE DRAWINGS

12/SWA/2046060 Site Plan. Civil Layout Demolition Works
14/SWA/2046090 Hazard Drawing. Site Hazard Plan
14/SWA/2046095 Site CDM Plan
21/SWA/2040001 Switchgear Layout

HOLDS

1 Flood wall details to be confirmed.

Rev	Rev. Date	Purpose of revision	Originator	Checker	Reviewer	Approver
P4	05.02.14	Flood wall location amended based on required clearances.	JR	DC	SB	AD
P3	23.01.14	Flood wall added.	JR	DC	SB	AD
P2	03.02.12	For Information	RJH	REW	SB	SB
P1	11.11.11	For Information	RJH	REW	SB	SB
P0	13.06.11	For Information	RIR	DC	SB	SB

PRELIMINARY

j2m
nationalgrid
Warwick Technology Park, Gallows Hill, Warwick, CV34 6DA

Drawing Title
SITE PLAN
SITE LAYOUT

SEABANK 400kV GIS SUBSTATION

Site
SEABANK 132kV/400kV SUBSTATION

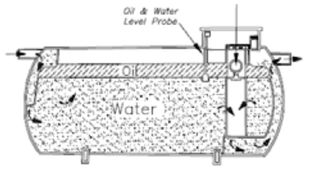
Scale	Sheet size	Sheet No.	Total Sheets.
1:300	A1	1	1

Originator Job No. B2916420
Revision P4
Drg No. 12/J2M/2046055
N.G. Project No. 20898

This drawing is not to be used in whole or part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.

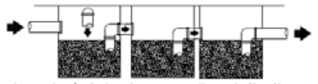
Issue		Purpose of Revision	Issue		Purpose of Revision
Drawn		NG Issue Description to go in here when required	Drawn		
Checked			Checked		
Approved / Date			Approved / Date		

Class 1 Full Retention 1 Chamber Oil Separator

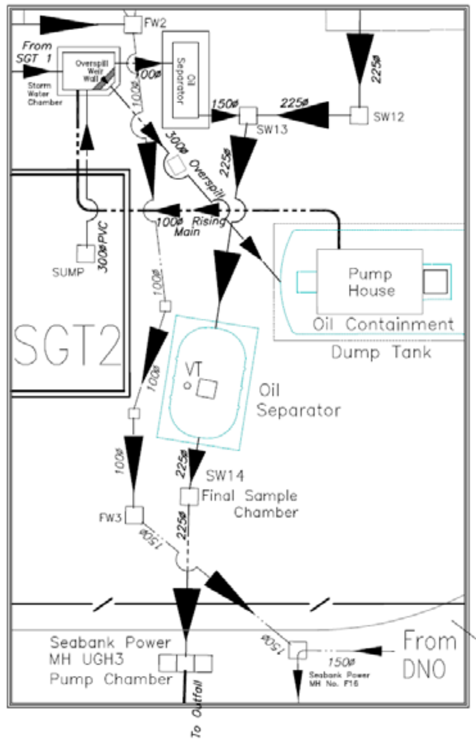


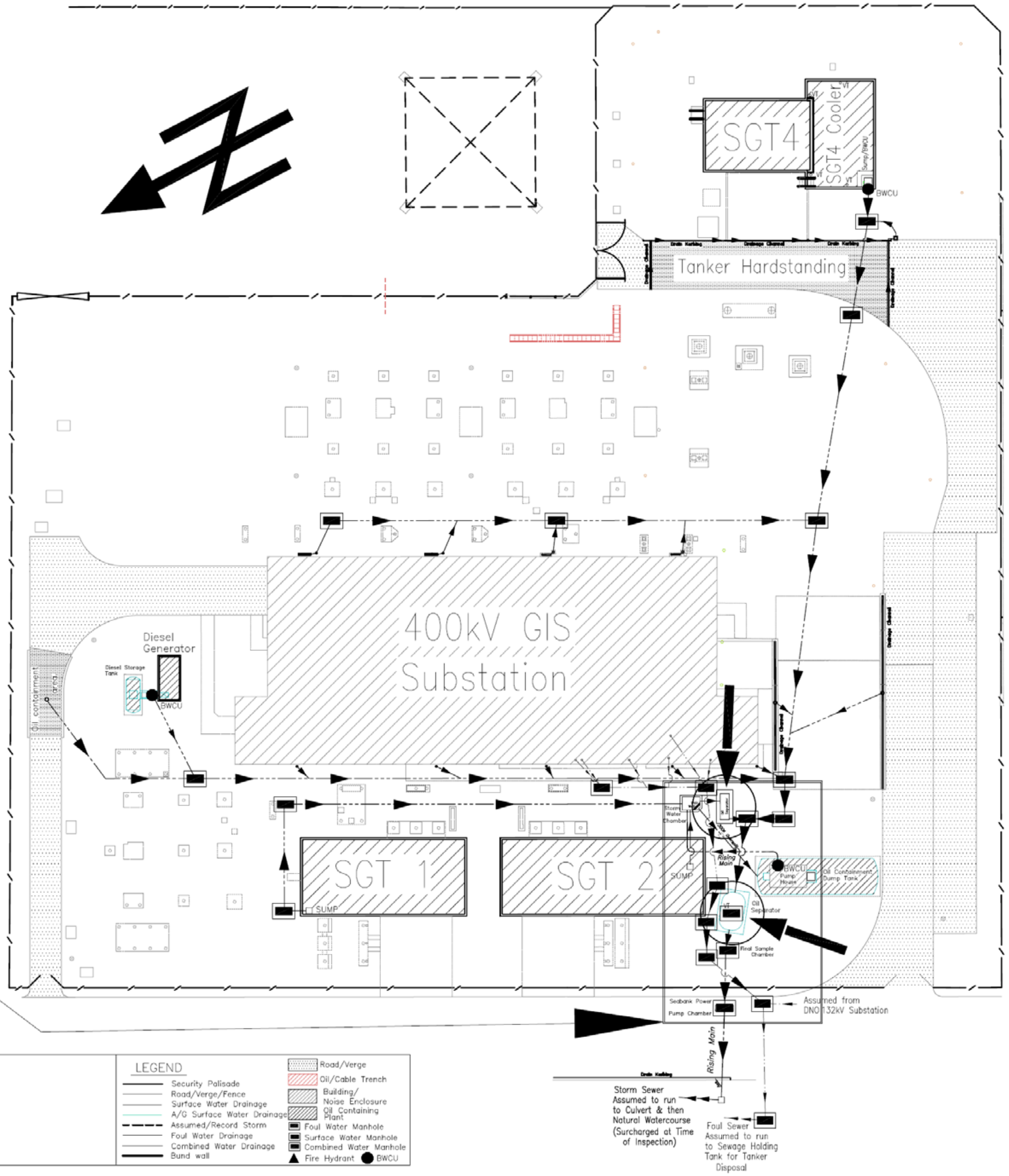
Separator unit operation to be checked at periodic intervals.
Retained oil in chamber, followed by silt, to be removed by Tanker.
Remove and check Automatic Closure Device.
Remove Automatic alarm/monitoring float device to clean and test operation.
In the event of a major spillage the Penstock valve should be closed and the Separator chambers emptied.

General Oil Separator Design



As contaminated water passes through the three chambers, immiscible hydrocarbon pollutants accumulate on the water surface, allowing the now treated water to discharge to the watercourse. The hydrocarbon pollutants and silt that build up within the separators should be periodically removed to ensure that maximum effectiveness of the unit is maintained. In the event of a major spillage the separators should be emptied immediately.





ISSUE	D	
DRAWN DATE	GHM (OnSite)	Aug:2013
CHECKED DATE	SS (OnSite)	Aug:2013
APPROVED DATE		

FOURTH ISSUE Drawing Revised after Site Inspection

LEGEND

- Security Palisade
- Road/Verge/Fence
- Surface Water Drainage
- A/G Surface Water Drainage
- Assumed/Record Storm
- Foul Water Drainage
- Combined Water Drainage
- Bund wall
- Road/Verge
- Oil/Cable Trench
- Building/ Noise Enclosure
- Oil Containing Plant
- Foul Water Manhole
- Surface Water Manhole
- Combined Water Manhole
- Fire Hydrant
- BWCU

Emergency Procedure

1. In the event of any spillage occurring, the Separator tanks marked thus– should be observed–ensuring that any float controlled closure device activates. If the device should fail, or no such device exists, closure of any penstocks should be performed manually.
2. Outfalls should be temporarily stoppered to allow oil containment devices to be put in place.
3. Emergency equipment from storage areas should be utilised to help contain the spillage.

Maintenance & Inspection Works

1. All covers indicated thus– should be inspected and emptied as required, contents being removed to an approved location.
2. Fitted alarm mechanisms should be tested.
3. Outfalls should regularly be observed for any evidence of contaminants.

The above work is to be carried out at intervals fixed by the area maintenance policy and observations/actions noted to area office.

Emergency Contact Arrangements

In the event of an incident contact should be made with the following :–

National Grid plc
UK Transmission
Warwick Tech Park Gallows Hill CV34 6DA

Emergency Oil Containment and Drainage Plan

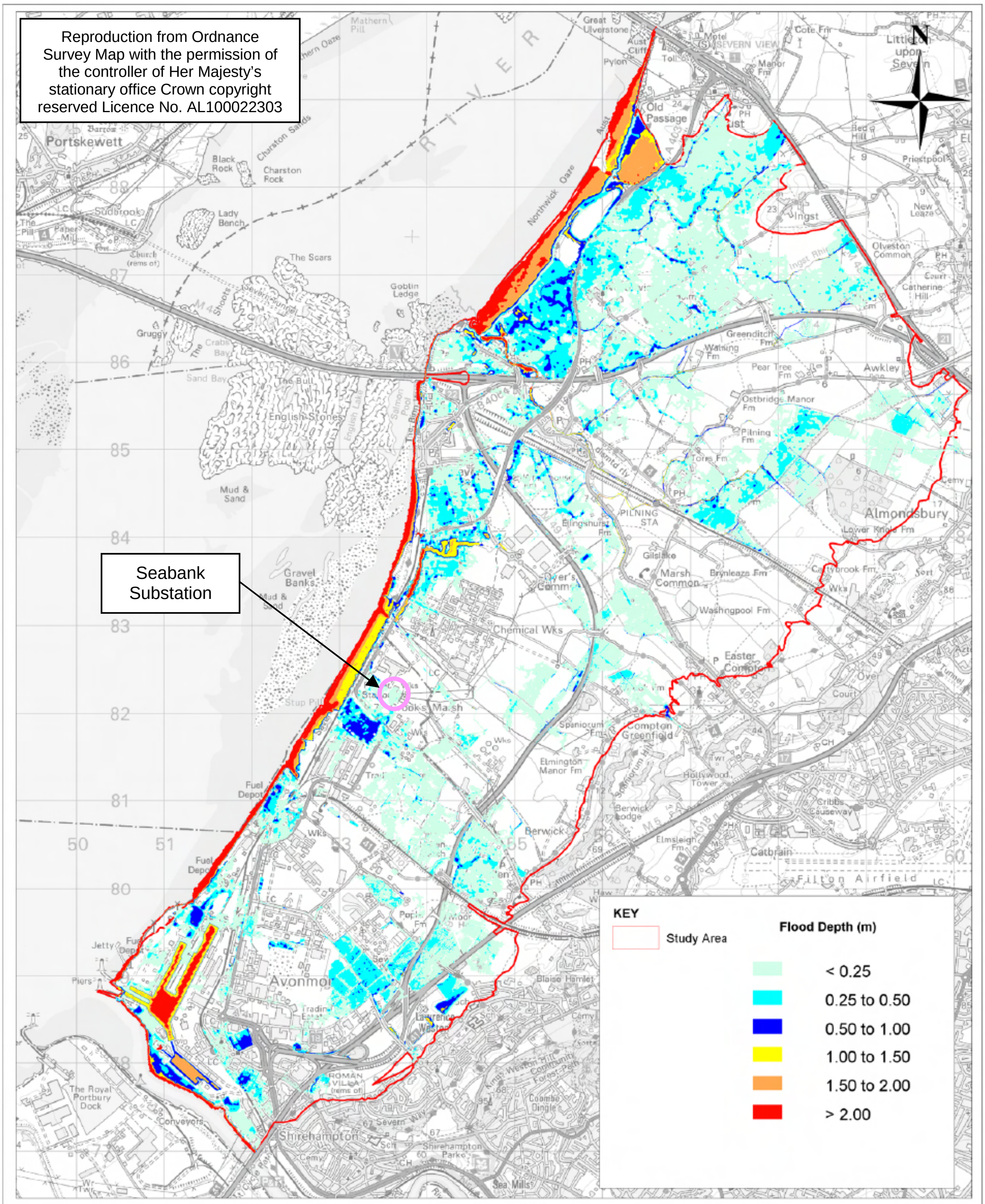
Seabank
National Grid Substation
400 GIS Substation

			A2
OnSite Drawing No: P477070/2			CAD
NG Drawing Number 12/18629	Sheet No. 1	No. of Sheets 1	ISSUE D
Scale: N.T.S.	NG Project No:		

OnSite
ONSITE CENTRAL LTD
89 BLACKPOLE WEST, BLACKPOLE
WORCESTER WR3 8TJ
TEL: (01905) 340054
FAX: (01905) 751571
E-mail: solutions@onsite.co.uk
Website: www.onsite.co.uk

Appendix C – SFRA Flood Maps

Inset 5.3. Flood Depth - 1 in 200 (0.5%) annual chance tidal event with 1 in 2 (50%) annual chance fluvial event at 2010 (present case)



Avonmouth/Severnside SFRA - September 2010

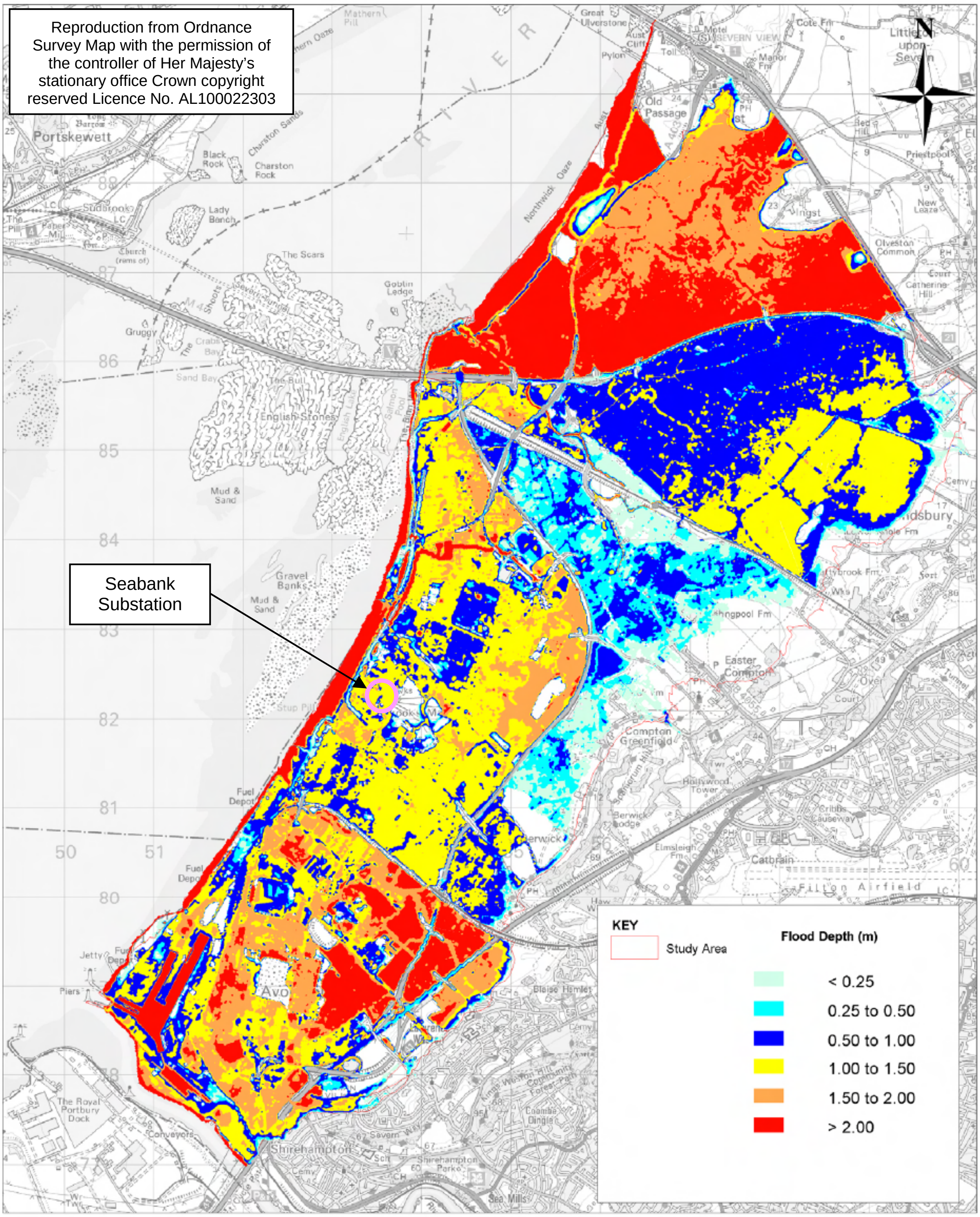
Actual Risk: Peak Flood Depths, Current Case
(Maximum Results From 2 Scenarios: S1 - 200 Year Tide, 2 Year Fluvial
S2 - 100 Year Fluvial, 2 Year Tide,
Figure 7.19

BRISTOL CITY COUNCIL
SOUTH GLOUCESTERSHIRE COUNCIL
LOWER SEVERN DRAINAGE BOARD

CAPITA SYMONDS

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A3	ISSUING OFFICE	DRAWING NUMBER	REV
BW	JT	CS	23/09/10	1:40000	BRISTOL	CS043163_BRI401	2

Inset 5.4. Flood Depth - 1 in 200 (0.5%) annual chance tidal event with 1 in 2 (50%) annual chance fluvial event at 2110 (future case)



Avonmouth/Severnside SFRA - September 2010

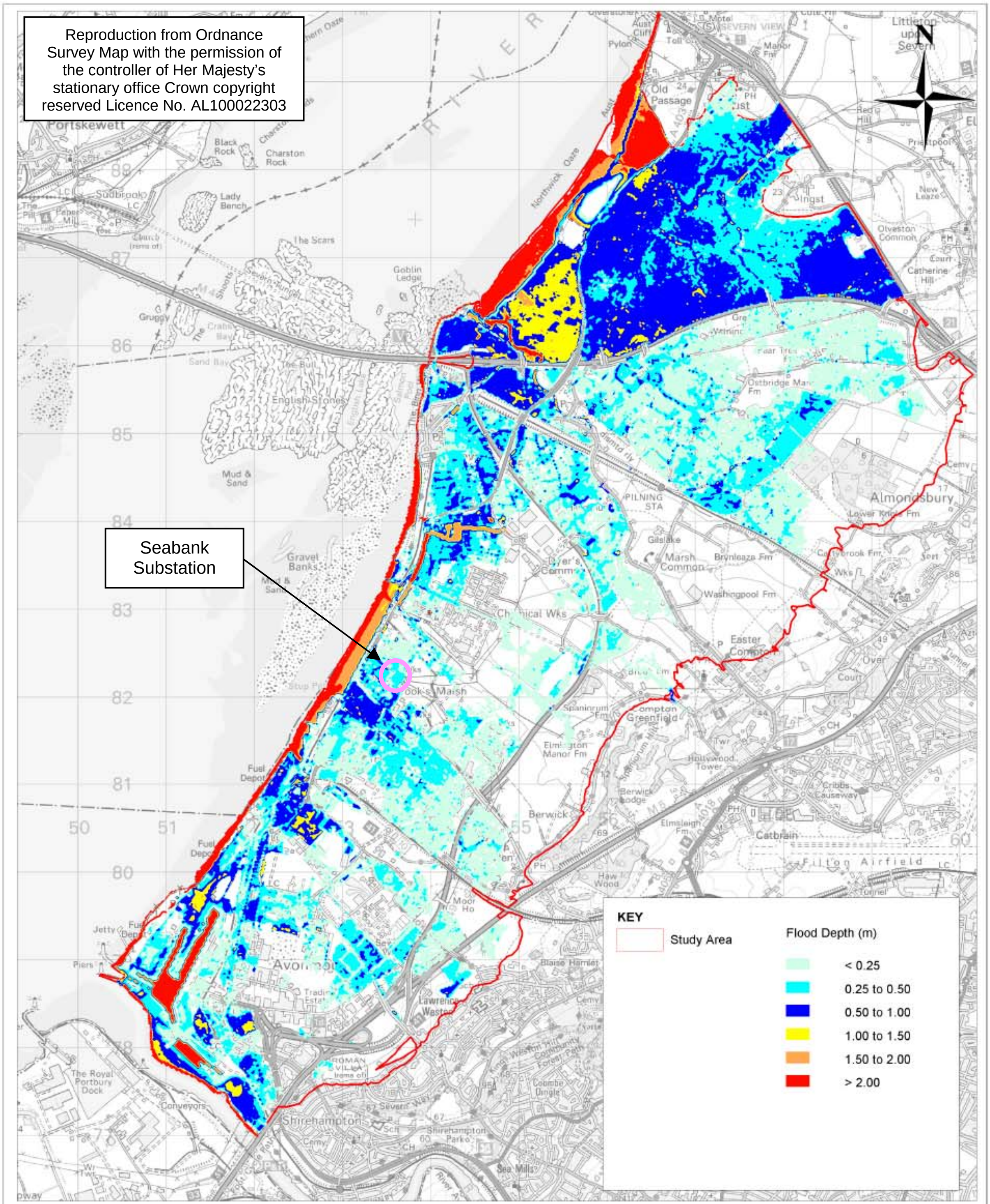
Actual Risk: Peak Flood Depths, Future Case
(Maximum Results From 2 Scenarios: S1 - 200 Year Tide, 2 Year Fluvial
S2 - 100 Year Fluvial, 2 Year Tide,
Figure 7.3

BRISTOL CITY COUNCIL
SOUTH GLOUCESTERSHIRE COUNCIL
LOWER SEVERN DRAINAGE BOARD

CAPITA SYMONDS

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A3	ISSUING OFFICE	DRAWING NUMBER	REV
BW	JT	CS	10/09/10	1:40000	BRISTOL	CS043163_BRI0115	6

Inset 5.5. Flood Depth - 1 in 1,000 (0.1%) annual chance tidal event with 1 in 2 (50%) annual chance fluvial event at 2010 (present case)



NOTE THE PROPERTY OF THIS DRAWING AND DESIGN IS VESTED IN CAPITA SYMONDS LIMITED AND MUST NOT BE COPIED OR REPRODUCED IN ANY WAY WITHOUT THEIR WRITTEN CONSENT

BASED ON ORDNANCE SURVEY MAPPING AND REPRODUCED BY CAPITA SYMONDS LTD LICENCE NO. 100023406 WITH THE PERMISSION OF THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE CROWN COPYRIGHT

Avonmouth/Severnside SFRA - September 2010

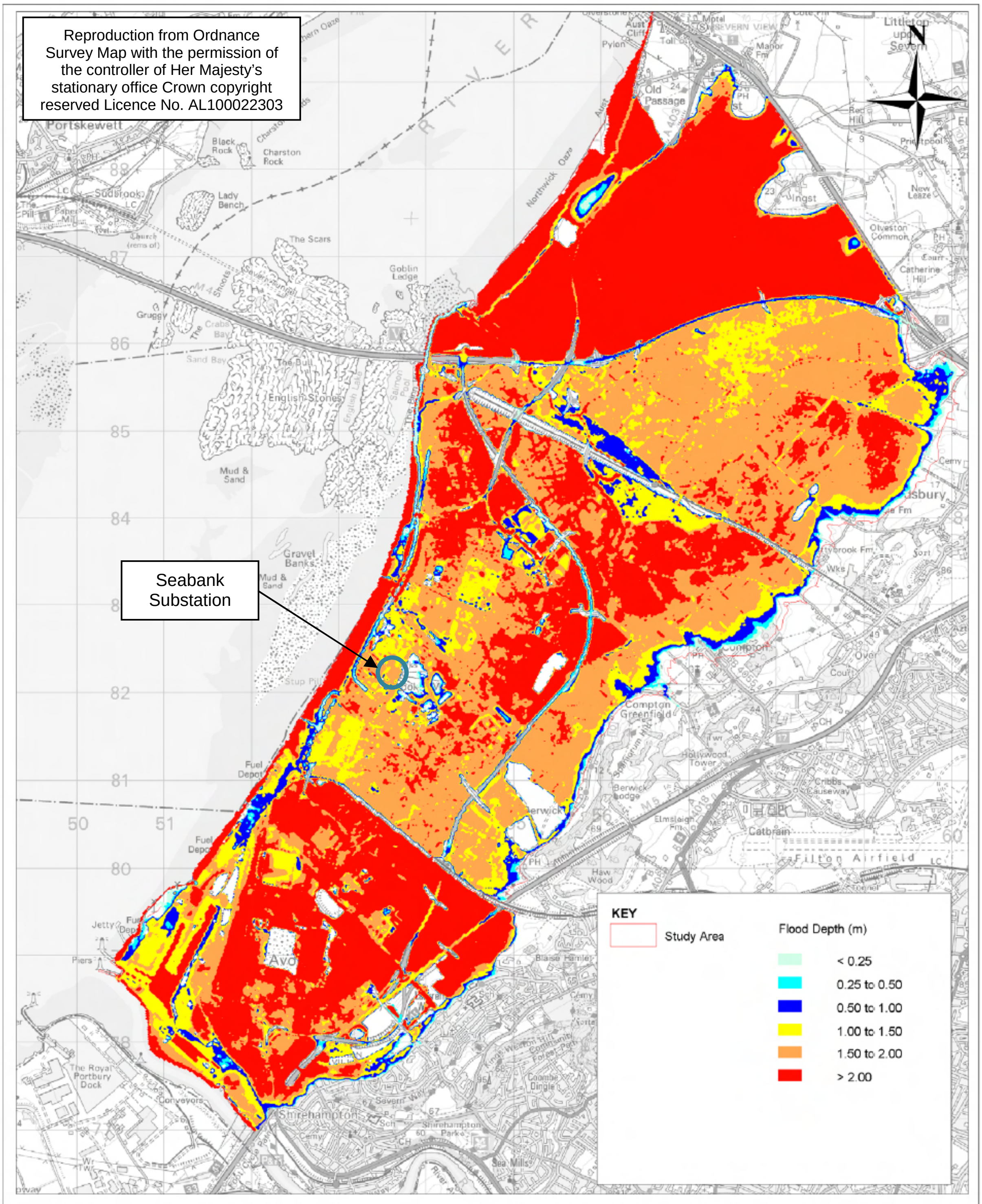
Residual Risk: Peak Flood Depths
(1000 Year Tide/Surge/Waves, 2 Year Fluvial With Defences, Current Case)
Figure 7.21

BRISTOL CITY COUNCIL
SOUTH GLOUCESTERSHIRE COUNCIL
LOWER SEVERN DRAINAGE BOARD

CAPITA SYMONDS

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A3	ISSUING OFFICE	DRAWING NUMBER	REV
BW	JT	CS	23/09/10	1:40000	BRISTOL	CS043163_BRI403	2

Inset 5.6. Flood Depth - 1 in 1,000 (0.1%) annual chance tidal event with 1 in 2 (50%) annual chance fluvial event at 2110 (future case)



NOTE THE PROPERTY OF THIS DRAWING AND DESIGN IS VESTED IN CAPITA SYMONDS LIMITED AND MUST NOT BE COPIED OR REPRODUCED IN ANY WAY WITHOUT THEIR WRITTEN CONSENT

BASED ON ORDNANCE SURVEY MAPPING AND REPRODUCED BY CAPITA SYMONDS LTD LICENCE NO. 100023406 WITH THE PERMISSION OF THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE CROWN COPYRIGHT

Avonmouth/Severnside SFRA - September 2010

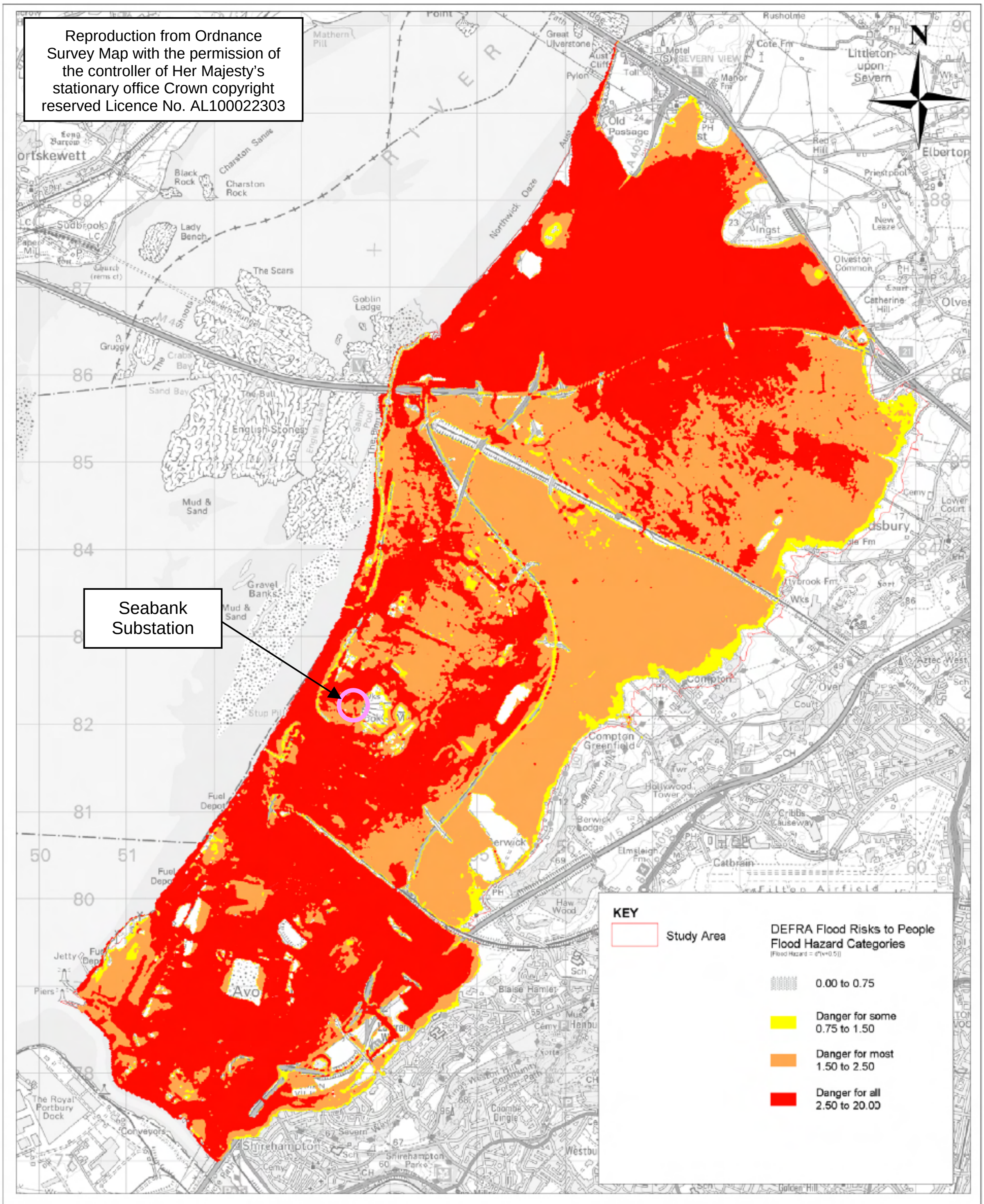
Residual Risk: Peak Flood Depths
(1000 Year Tide/Surge/Waves, 2 Year Fluvial With Defences, Future Case)
Figure 7.15

BRISTOL CITY COUNCIL
SOUTH GLOUCESTERSHIRE COUNCIL
LOWER SEVERN DRAINAGE BOARD

CAPITA SYMONDS

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A3	ISSUING OFFICE	DRAWING NUMBER	REV
BW	JT	CS	23/09/10	1:40000	BRISTOL	CS043163_BRI0126	6

Inset 5.7. Flood Hazard - 1 in 1,000 (0.1%) annual chance tidal event with 1 in 2 (50%) annual chance fluvial event at 2110 (future case) for overtopping scenario



NOTE THE PROPERTY OF THIS DRAWING AND DESIGN IS VESTED IN CAPITA SYMONDS LIMITED AND MUST NOT BE COPIED OR REPRODUCED IN ANY WAY WITHOUT THEIR WRITTEN CONSENT

BASED ON ORDNANCE SURVEY MAPPING AND REPRODUCED BY CAPITA SYMONDS LTD LICENCE NO. 100023406 WITH THE PERMISSION OF THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE CROWN COPYRIGHT

Avonmouth/Severnside SFRA - September 2010

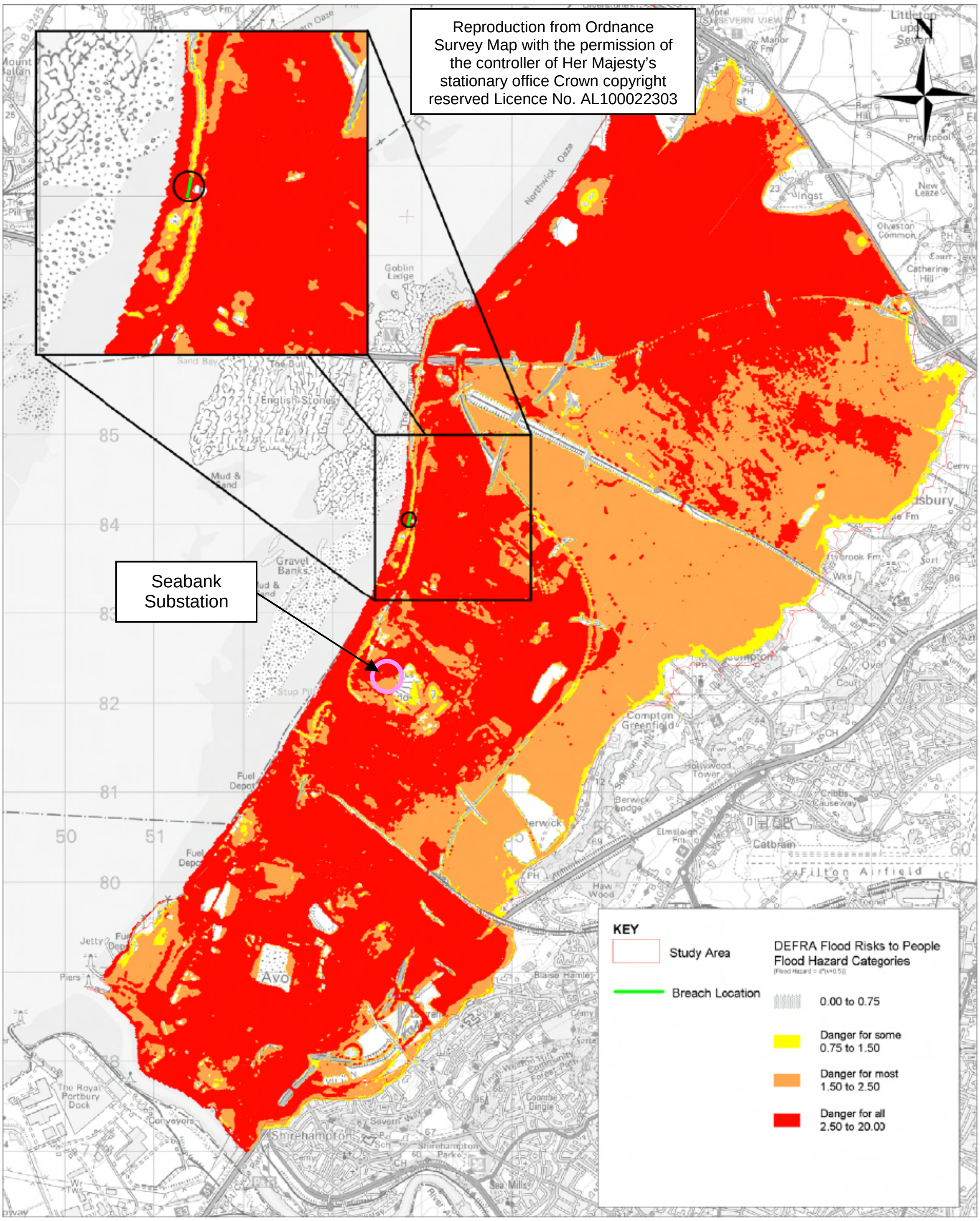
Residual Risk: Peak Flood Hazard (DEFRA)
(1000 Year Tide/Surge/Waves, 2 Year Fluvial With Defences, Future Case)
Figure 7.16

BRISTOL CITY COUNCIL
SOUTH GLOUCESTERSHIRE COUNCIL
LOWER SEVERN DRAINAGE BOARD

CAPITA SYMONDS

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A3	ISSUING OFFICE	DRAWING NUMBER	REV
BW	JT	CS	23/09/10	1:40000	BRISTOL	CS043163_BRI0126c	6

Inset 5.8. Flood Hazard - 1 in 1,000 (0.1%) annual chance tidal event with 1 in 2 (50%) annual chance fluvial event at 2110 (future case) for breach scenario 1



Avonmouth/Severnside SFRA - September 2010

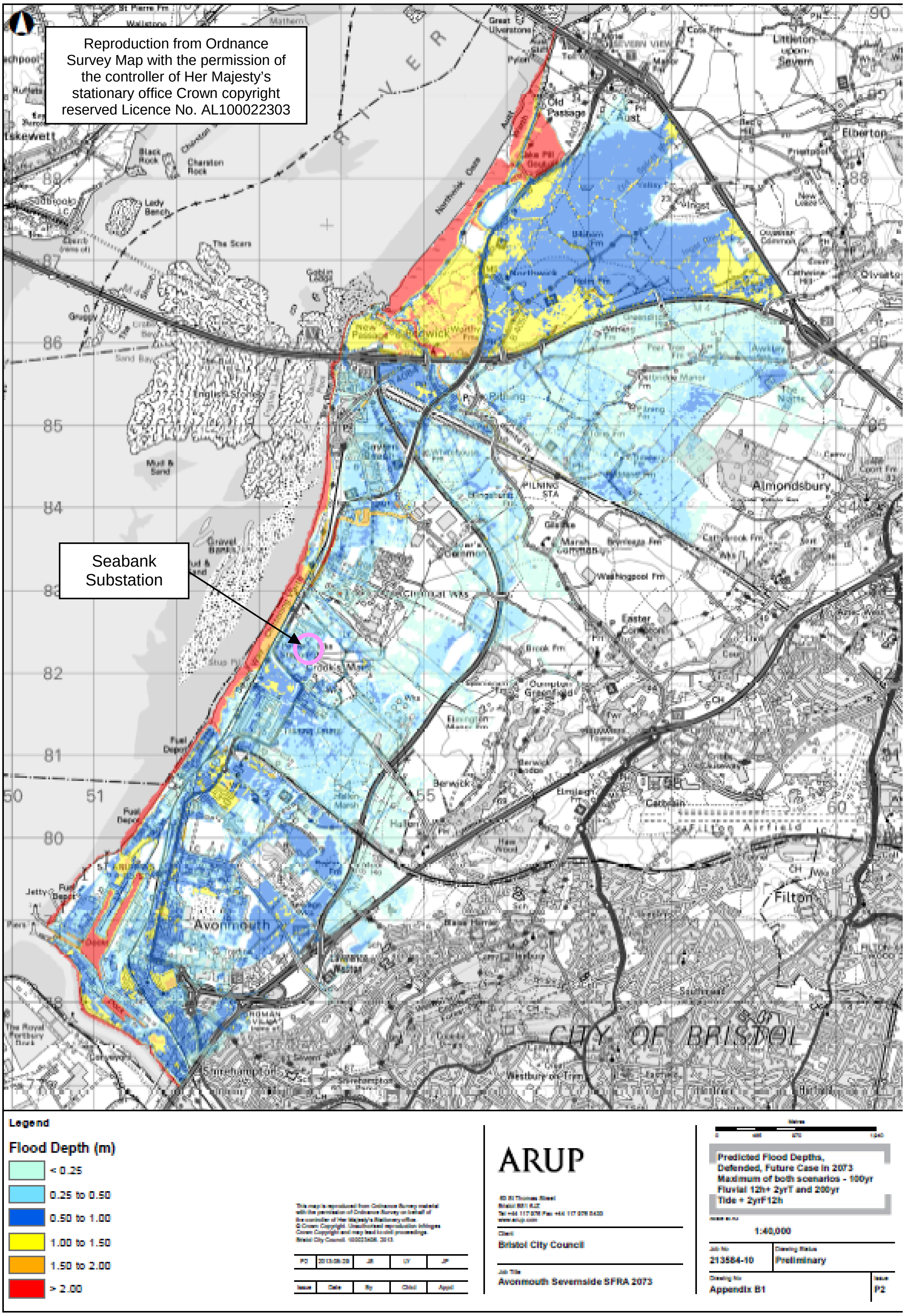
Breach Scenario 1 - 1000 Year Tide and 2 Year Fluvial For Future Case
Figure 7.6

BRISTOL CITY COUNCIL
SOUTH GLOUCESTERSHIRE COUNCIL
LOWER SEVERN DRAINAGE BOARD

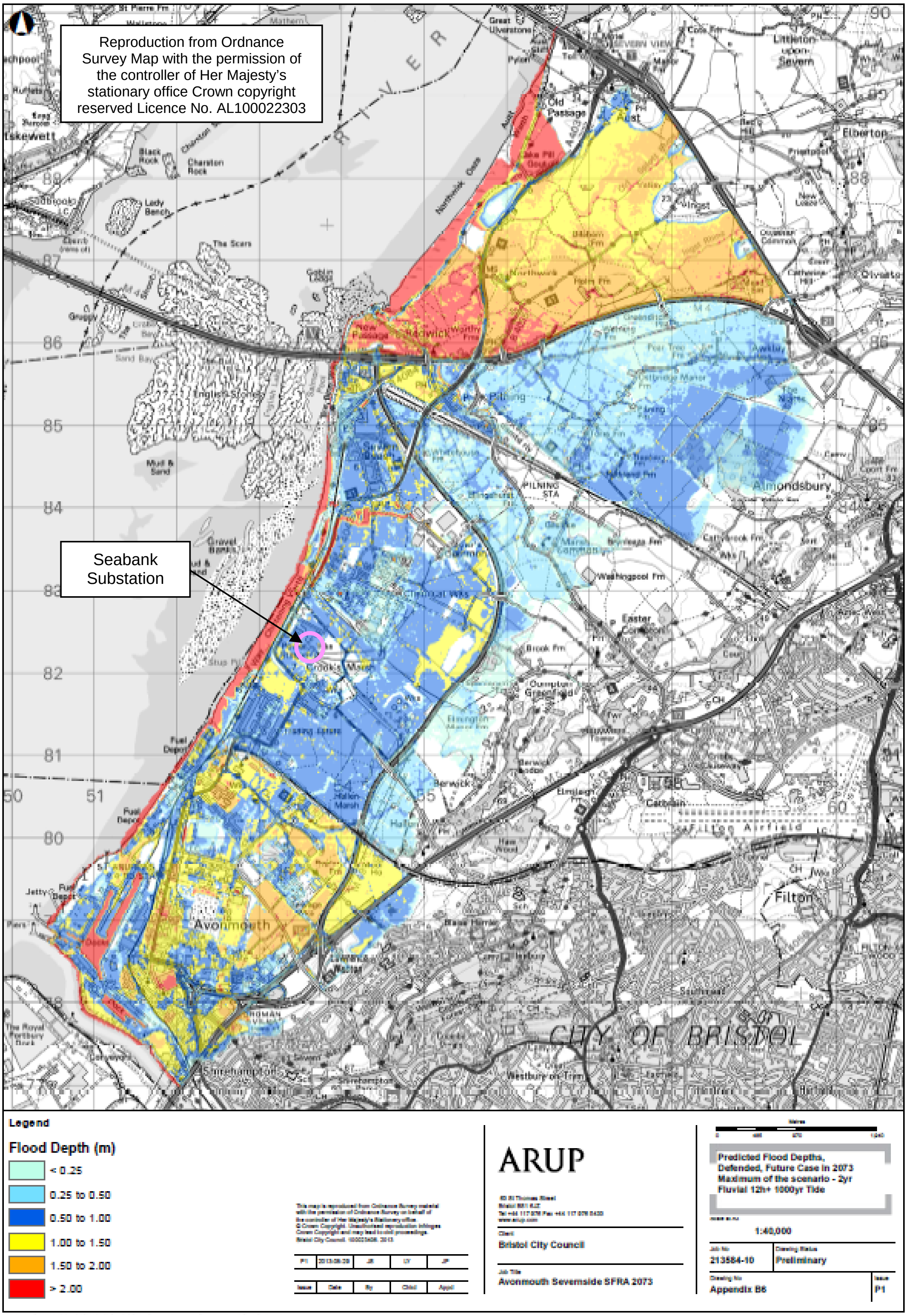
CAPITA SYMONDS

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A3	ISSUING OFFICE	DRAWING NUMBER	REV
BW	JT	CS	10/09/10	1:40000	BRISTOL	CS043163_BRI0117b	6

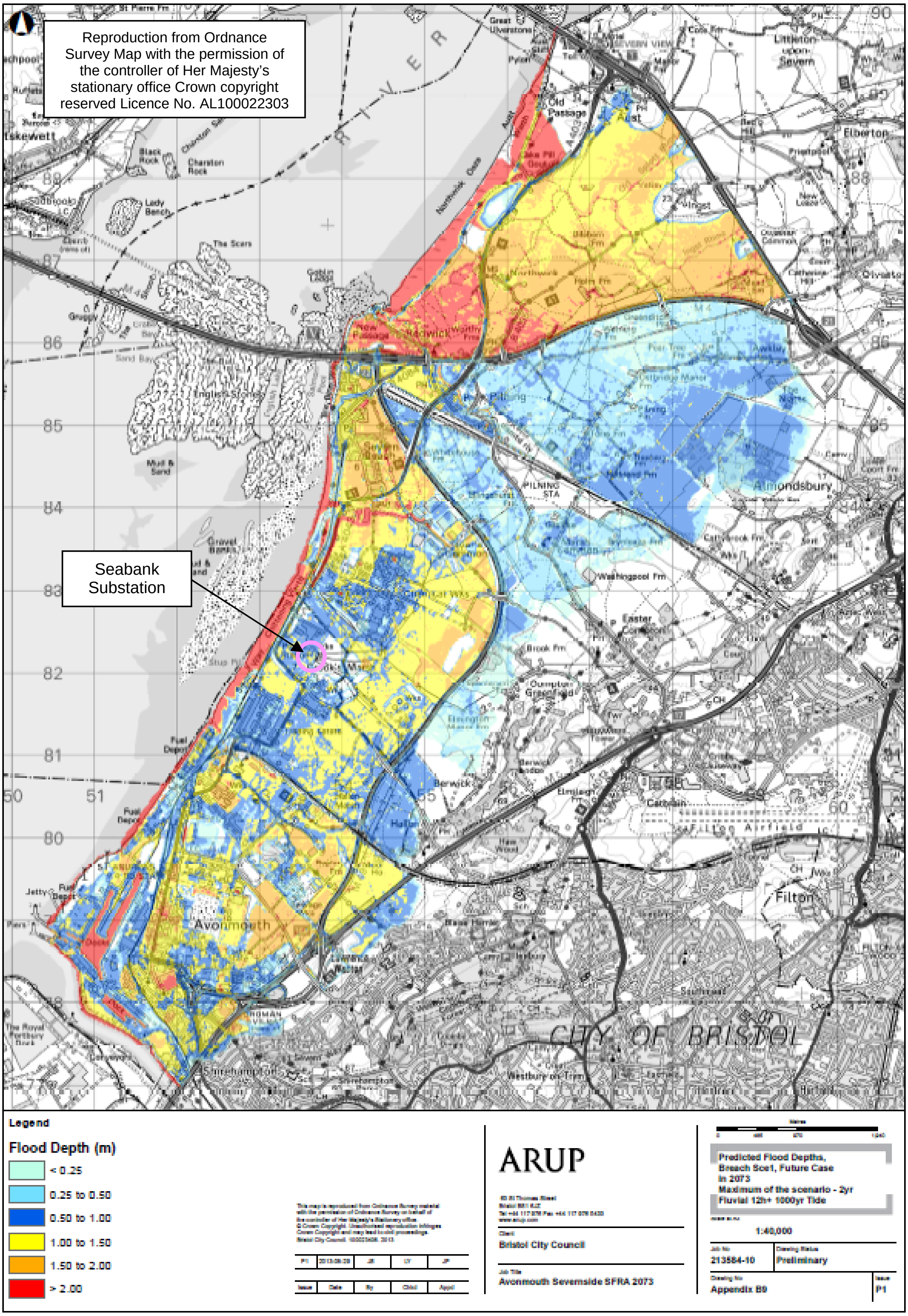
Inset 5.9. Flood Depth - 1 in 200 (0.5%) annual chance tidal event with 1 in 2 (50%) annual chance fluvial event at 2073 (future case)



Inset 5.10. Flood Depth - 1 in 1,000 (0.1%) annual chance tidal event with 1 in 2 (50%) annual chance fluvial event at 2073 (future case)



Inset 5.11. Flood Depth - 1 in 1,000 (0.1%) annual chance tidal event with 1 in 2 (50%) annual chance fluvial event at 2073 (future case) for breach scenario 1



Appendix D – Environment Agency Correspondence

Daniel Mutepfa
William Saunders
[redacted]@wm-saunders.co.uk

Our ref: NWX/CSC/3685
Your ref:

Date: 21 September 2011

Dear Mr Mutepfa

Information request – Product 4: **Seabank Substation, Seabank**

Thank you for your enquiry of 07/09/2011. We are happy to provide the following information:

Flood Risk
The Flood Map indicates that this site is within Flood Zone 3.

For your information enclosed is a Flood Map. There are two different kinds of area shown on the Flood Map. They can be described as follows:

Flood Zone 3 - is shaded dark blue and shows the area that could be affected by flooding, either from rivers or the sea, if there were no flood defences. This area could be flooded:

- from the sea by a flood that has a 0.5% (1 in 200) or greater chance of happening each year.
- or from a river by a flood that has a 1% (1 in 100) or greater chance of happening each year.

Flood Zone 2 - is shaded light blue and shows the additional extent of an extreme flood from rivers or the sea. These outlying areas are likely to be affected by a major flood, with up to a 0.1 per cent (1 in 1000) chance of occurring each year.

These two colours show the extent of the natural floodplain if there were no flood defences or certain other man-made structures and channel improvements. The outer edge of this zone is referred to as the 'Extreme Flood Outline' (EFO). Land outside the EFO is termed Flood Zone 1.

The purple line shows all flood defences built in the last five years to protect against river floods with a 1 per cent (1 in 100) chance of happening each year, or floods from the sea with a 0.5 per cent (1 in 200) chance of happening each year, together with some, but not all, older defences and defences which protect against smaller floods. Flood defences that are not yet shown, and the areas that benefit from them, will be gradually added. For more information on the Flood Defences shown please find attached a map and two tables from our National Flood and Coastal Defence Database (NFCDD) for both the Avonmouth and Severn Beach areas.

Hatched areas benefit from the flood defences shown, in the event of a river flood with a 1 per cent (1 in 100) chance of happening each year, or a flood from the sea with a 0.5 per cent (1 in 200) chance of happening each year. If the defences were not there, these areas would be flooded. Areas Benefiting from Defences have not been produced for this area to-date.

Flood defences do not completely remove the chance of flooding, however, and can be overtopped or fail in extreme weather conditions.

The map and associated information is intended for guidance, and cannot provide details for individual properties. The Flood Map is not property specific and only covers flooding from rivers and the sea. Flooding can occur at any time and in any place from sources such as rising ground water levels, burst water mains, road drains, run-off from hillsides and sewer overflows.

Flood Levels
Below is a table providing Tidal Extreme Still Water level data and confidence intervals for Avonmouth.

Period/Notes	The following still water tide levels are for **Avonmouth** and are subject to Notes 1 to 7 below.	
PERIOD	**LEVEL in mAOD** (please see note 7 below)	**CONFIDENCE INTERVALS (± m)**
5% AEP	8.67	0.2
0.5% AEP	9.11	0.4
0.1% AEP	9.43	0.6
Note 1.	The current source of the data is from the "Coastal Flood Boundary Conditions for UK Mainland and Islands" project, February 2011 and the base year for the data is 2008.	
Note 2.	Confidence levels for coastal sites are shown. Careful consideration should be given to these values when considering whether the data is fit for purpose for the intended use.	
Note 3.	Extreme sea level values shown above are for still water levels only. They do include the effects of storm surge but do not account for any local wave set up, which needs to be calculated separately.	
Note 4.	Estuary sites have been derived by calculating the difference between coastal locations to the estuary locations, the confidence bands for these values has not been calculated, however confidence in estuary levels will be less than for the coastal levels.	
Note 5.	The tidal levels quoted do not take account of Climate Change. For the purposes of your FRA you will need to calculate the Climate Change figure applicable to your development. To do this you will need to refer to current Defra guidance on sea level rise. If you have any queries about this please contact our Development and Flood Risk Team.	
Note 6.	AEP = Annual Exceedance Probability - e.g. 1% AEP has a 1% chance of occurring in any one year (1:100 chance)	
Note 7.	AOD stands for "Above Ordnance Datum" and is a standard surveying datum used to derive altitude in the UK. More information can be found from Ordnance Survey - http://www.ordnancesurvey.co.uk/	

Unfortunately on this occasion we do not have any modelled fluvial or historic flood levels to assist with your flood risk assessment. However, we would refer you to the web link below for standing advice on Flood Risk Assessments.

Historic Flood Events
Following examination of our records of Historic Flooding we have no record of flooding in the area. This does not mean that the area of the property / site has never flooded, only that we do not currently have records of flooding in this area**.**

Main River and Flood Defence Consents
The bank top ePlanning tool shows a band of 20m adjacent to each bank of a designated Main River, shown by the red line. Development works or structures, whether permanent or

temporary, within this area may be subject to gaining our Flood Defence Consent. Please contact our Development and Flood Risk team for further information.

Further Information
We advise that you also contact the local authority Drainage Engineer as they may be able to provide further advice with respect to localised flooding and drainage issues.

Further details about the Environment Agency information supplied can be found on our website:
http://www.environment-agency.gov.uk/homeandleisure/floods/default.aspx
Flood Map: http://publications.environment-agency.gov.uk/pdf/GEH00306BKIY-e-e.pdf?lang=_e
Flood Risk Standing Advice: http://www.environment-agency.gov.uk/research/planning/82584.aspx

We hope you find this information helpful and it is provided subject to the notice overleaf, which we strongly recommend you read.

Yours sincerely

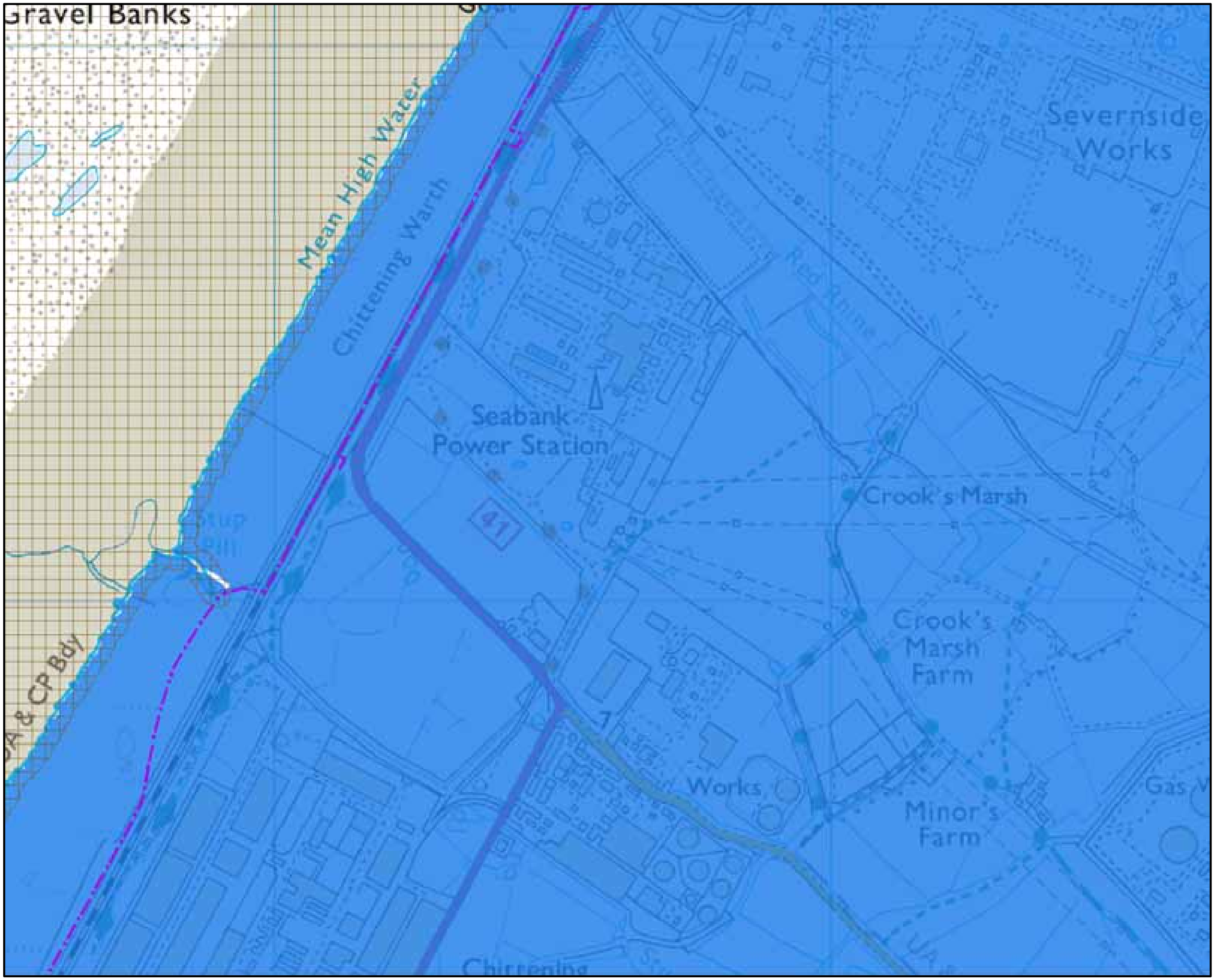
[redacted]

NATASHA TURNER
External Relations Officer

Enc: Standard Notice
Flood Map
Avonmouth Defence Data
Avonmouth Defence Map
Avonmouth Structure Data
Severn Beach Defence Data
Severn Beach Defence Map
Severn Beach Structure Data

The Environment Agency
Rivers House, East Quay, Bridgwater, Somerset TA6 4YS
Tel: 08708 506506 Fax: 01278 452985 DX 135476 Bridgwater 3
Email: enquiries@environment-agency.gov.uk
www.environment-agency.gov.uk

Flood Map centred on ST 53600 82200 - created 16/09/11 Ref: CSC/3685



Environment Agency

Scale: 1:10,000

Legend

- Flood Map - Defences
- Areas Benefiting from Flood Defences
- Flood Map - Flood Storage Areas
- Main River
- Bank Top ePlanning Tool
- Flood Zone 3
- Flood Zone 2

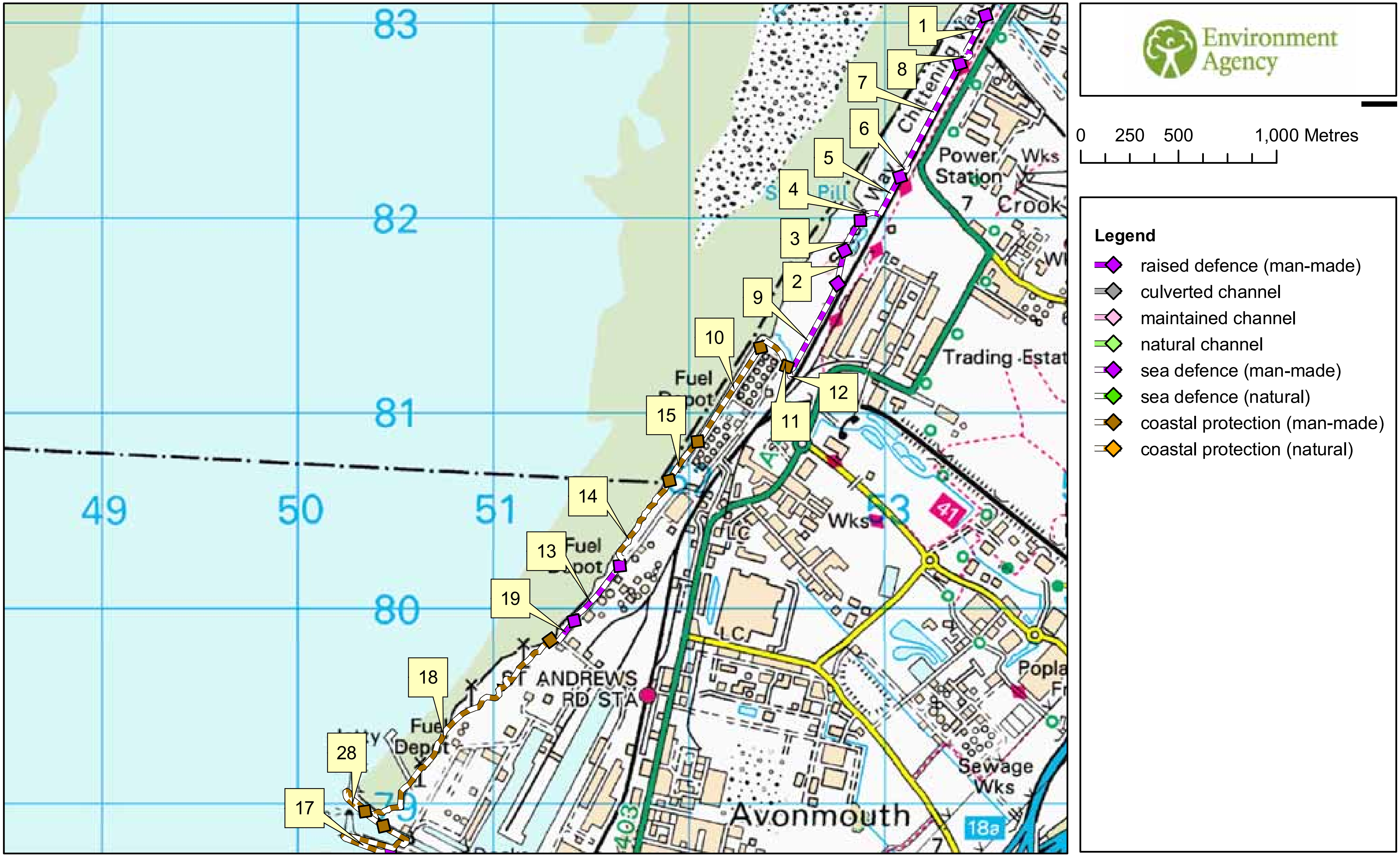
Flood Map Areas (assuming no defences)

Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

NFCDD Defence Information - Avonmouth area



Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Product 4 - NFCDD Information - Linear Assets - Avonmouth area. Correct as at 16 September 2011.

This data has been extracted from the National Flood and Coastal Defence Database (NFCDD) which was created to draw various sources into one database and has been populated with information of varying quality.

Map Ref	Asset Reference	Asset Type	Asset Description	Approx Length (m)	Effective crest level (mAOD)	Crest level estimated accuracy	NGR	Actual Standard of Protection	Most Recent Inspection	Overall Condition*
1	112GF22200201C06	sea defence (man-made)	Embankment Defence formed from rail embankment	251	9.49	+/- >5 to 15cm	ST5342682848	-999	24/11/2009	2
2	112GF22200102C03	sea defence (man-made)	Earth Embankment Defence	172	9.90	+/- 1 to 5cm	ST5277481701	-999	23/11/2010	2
3	112GF22200102C04	sea defence (man-made)	Earth Embankment Defence	177	9.64	+/- 1 to 5cm	ST5281681868	-999	23/11/2010	2
4	112GF22200201C01	sea defence (man-made)	Earth Embankment Defence	72	9.12	+/- 1 to 5cm	ST5291382015	-999	24/11/2009	2
5	112GF22200201C02	sea defence (man-made)	Embankment Defence formed from rail embankment	261	9.49	+/- >5 to 15cm	ST5298382015	-999	24/11/2009	2
6	112GF22200201C03	sea defence (man-made)	Earth Embankment Defence, around rail opening	44	9.48	+/- 1 to 5cm	ST5310682244	-999	22/11/2007	2
7	112GF22200201C04	sea defence (man-made)	Embankment Defence formed from rail embankment	635	9.49	+/- >5 to 15cm	ST5311682262	-999	24/11/2009	2
8	112GF22200201C05	sea defence (man-made)	Earth Embankment Defence, around rail opening	71	9.33	+/- 1 to 5cm	ST5341382824	-999	24/11/2009	2
9	112GF22200102C02	sea defence (man-made)	Earth Embankment Defence incorporating Mitchells outfall	569	9.44	+/- 1 to 5cm	ST5252481198	-999	23/11/2010	2
10	112GF22200101C05	coastal protection (man-made)	Raised earth and rubble embankment without erosion protection	580	10.67	+/- 1 to 5cm	ST5207880883	-999	24/11/2009	3
11	112GF22200101C06	coastal protection (man-made)	Raised earth & rubble embankment without erosion protection	220	9.22	+/- 1 to 5cm	ST5239681369	-999	24/11/2009	3
12	112GF22200102C01	sea defence (man-made)	RC Flood Wall Defence	20	9.10	+/- >5 to 15cm	ST5253281182	-999	16/11/2007	2
13	112GF22200101C02	sea defence (man-made)	Floodwall... Roadside concrete curb/barrier raised to height with courses of breeze blocks	368	9.50	+/- >5 to 15cm	ST5144279968	-999	23/11/2010	2
14	112GF22200101C03	coastal protection (man-made)	Wide raised earth & rubble embankment without erosion protection	548	8.73	+/- 1 to 5cm	ST5167380253	-999	24/11/2009	3
15	112GF22200101C04	coastal protection (man-made)	Raised earth and rubble embankment without erosion protection	246	10.80	+/- 1 to 5cm	ST5192980688	-999	24/11/2009	3
17	112GES8401001C02	coastal protection (man-made)	Dock walls	780	9.30	+/- > 75cm	ST5045278752	-999	02/03/2010	3
18	112GES8351001C02	coastal protection (man-made)	Warth	1503	9.50	+/- > 75cm	ST5038478933	-999	02/03/2010	3
19	112GF22200101C01	sea defence (man-made)	Floodwall... Roadside concrete curb/barrier raised to height with courses of dense aggregate blocks	174	9.50	+/- >5 to 15cm	ST5133979829	-999	24/11/2010	2
28	112GES8351001C01	coastal protection (man-made)	Pier wall	426	9.30	+/- > 75cm	ST5040978905	-999	02/03/2010	3

*** Overall condition has been taken from the most recent inspection. Please note that the inspections are of a purely visual nature and do not necessarily reflect the true condition of the asset**

Condition 1 = very good, condition 2 = good, condition 3 = fair, condition 4 = poor, condition 5 = very poor.

Note: -999 = data not recorded

Product 4 - NFCDD Information - Structures with a Sea Defence role - Avonmouth area. Correct as at 16 September 2011.

This data has been extracted from the National Flood and Coastal Defence Database (NFCDD) which was created to draw various sources into one database and has been populated with information of varying quality.

Asset Reference	Asset Type	Asset Description	NGR	Most Recent Inspection	Overall Condition*
112GF22200101C04001	sea defence structure	Quad 1.5m sq F/O/F, Holesmouth Sewage and storm O/F	ST5196080680	23/11/2010	3
112GF22200101C05001	sea defence structure	Hallen Marsh (1) Outfall 250mm dia O/F	ST5213081010	23/11/2010	3
112GF22200101C05002	sea defence structure	Hallen Marsh (2) Outfall, 250mm dia F/O/F	ST5216081070	23/11/2010	3
112GF22200102C02002	sea defence structure	Mitchells trib. outfall 300mm dia F/O/F	ST5252981267	23/11/2010	2
112GF22200102C02001	sea defence structure	Mitchells Salt Rhine Outfall Twin 1.35m dia F/O/F, Invert level = 4.65mAOD	ST5253181220	23/11/2010	2
112GF22200101C03001	sea defence structure	250mm dia F/O/F, surface water outfall No.3	ST5162080220	23/11/2010	3
112GF22200101C03002	sea defence structure	100mm dia F/O/F, Outfall No.2	ST5173080370	24/03/2011	1
112GF22200101C03003	sea defence structure	225mm dia F/O/F, Outfall No.1	ST5180080470	23/11/2010	3
112GF22200101C02001	sea defence structure	600mm dia F/O/F, Unnamed Outfall	ST5140079930	23/11/2010	3
112GF22200101C02002	sea defence structure	750mm dia F/O/F, Unnamed Outfall	ST5144079980	23/11/2010	3
112GF22200101C02003	sea defence structure	100mm dia F/O/F, Outfall No. 4	ST5173080370	23/11/2010	3
112GF22200101C01001	sea defence structure	Twin 1.5x2.1m rec F/O/F, Elbury (Kingweston) O/F.	ST5132679837	23/11/2010	3
112GF22200201C05001	sea defence structure	225mm dia F/O/F, Def' D/S drain Outfall	ST5342482818	24/11/2009	2
112GF22200201C05002	sea defence structure	225mm dia F/O/F, Def' U/S drain Outfall	ST5344082850	24/11/2009	1
112GF22200102C04001	sea defence structure	Stup Pill Outfall Twin 2.1m sq F/O/F,	ST5291782012	23/11/2010	2
112GF22200201C07001	sea defence structure	New Pill Outfall Twin 2.1m dia F/O/F,	ST5356083066	24/11/2009	1

*** Overall condition has been taken from the most recent inspection. Please note that the inspections are of a purely visual nature and do not necessarily reflect the true condition of the asset**

Condition 1 = very good, condition 2 = good, condition 3 = fair, condition 4 = poor, condition 5 = very poor.

Note: -999 = data not recorded, OF = outfall, FOF = flapped outfall

From: Bull, Richard [[redacted]@environment-agency.gov.uk]
Sent: 27 October 2011 14:12
To: Daniel Mutepfa
Subject: Seabank Substation

Dear Mr Mutepfa

FLOOD DEFENCES AROUND ELECTRICAL SUBSTAION FOR NATIONAL GRID AT SEABANK ELECTRICAL SUBSTATION, SEVERN ROAD, AVONMOUTH, BRISTOL
Thank you for your enquiry regarding the above proposal, which was received on 10 October 2011.

The Environment Agency can confirm that the site does fall within tidal Flood Zone 3 which is an area with the highest probability of flooding (1:200 year). We understand the electrical substation is classed as 'Essential Infrastructure' under Table D.1 of PPS25. Table D.3 of PPS25 states that 'Essential Infrastructure' is appropriate in Flood Zone 3. However, a Flood Risk Assessment (FRA) should be submitted to support a planning application for the development.

We can advise that the FRA supporting this proposal should establish the likely flood level over the lifetime of the development, in order to determine the necessary height of the flood defences. The best available flood risk information for the site can be found in the "Avonmouth / Severnside Strategic Flood Risk Assessment Level 2. February 2011", which can be downloaded from the following link:
http://www.bristol.gov.uk/page/strategic-flood-risk-assessment-sfra.

The FRA should state what return period the flood defences will be designed to. As they will defend critical national infrastructure, we would advise that as a minimum this should be the 1:200 year level, including an allowance for climate change.

The FRA should then analyse the impact the proposed flood defences will have on surrounding third party land. This analysis should be carried out in the context of the tidal cell in which the site is located, i.e. over the lifetime of the development will the depth of flooding increase around the site due to the flood defences displacing flood water? Mitigation measures should be proposed where necessary.

The FRA should also clarify what surface water drainage arrangements will be incorporated when the flood defences are constructed to ensure that sufficient drainage is provided within the defended area. This is required to ensure that the risk of surface water flooding is not increased either in or around the flood defences.
Please submit a draft of the FRA document to us prior to submitting a planning application to enable us to give further feedback.

An ecological survey should also be submitted with any submission for planning.

Please quote the Agency's reference on any future correspondence regarding this matter.

Yours sincerely

RICHARD BULL
Planning Liaison Officer

Direct dial [redacted]
Direct fax [redacted]
Direct e-mail [redacted]@environment-agency.gov.uk

Appendix E – NPS Requirements and Compliance

EN-1 - Overarching Energy

EN-1 Section	Para no.	Requirement as stated in the NPS	Compliance and Comment Related to the FRAs
Criteria for 'good design' for energy infrastructure	4.5.3	The IPC needs to be satisfied that energy infrastructure developments are sustainable and, having regard to regulatory and other constraints, are as attractive, durable and adaptable (including taking account of natural hazards such as flooding) as they can be.	All flooding hazards are considered, with specific comment included on being adaptable (related to building in adaptive capacity) in the event of (1) climate change being different from what may currently be anticipated; (2) current flood risk management plans and strategies changing over the lifetime of the development; (3) the need for continued operation at various sites beyond the currently planned 40 year operational life.
Climate Change Adaptation	4.8.5	New energy infrastructure will typically be a long-term investment and will need to remain operational over many decades, in the face of a changing climate. Consequently, applicants must consider the impacts of climate change when planning the location, design, build, operation and, where appropriate, decommissioning of new energy infrastructure. The ES should set out how the proposal will take account of the projected impacts of climate change. While not required by the EIA Directive, this information will be needed by the IPC.	The FRAs take account of projected climate change with regard to rising sea levels, increases in river flows, and increased rainfall intensity. The impacts are addressed through designing for the future at present, as well as building in adaptive capacity for any futher future adaptations in line with the precautionary principle so as to NOT affect the ability to make future adaptations.
	4.8.6	The IPC should be satisfied that applicants for new energy infrastructure have taken into account the potential impacts of climate change using the latest UK Climate Projections available at the time the ES was prepared to ensure they have identified appropriate mitigation or adaptation measures. This should cover the estimated lifetime of the new infrastructure.	UKCP09 projections have been used for sea level rise and rainfall intensity. For fluvial flows, climate change scenarios from various exisiting models (including SFRA level 2 assessments) have been used.
	4.8.7	Applicants should apply as a minimum, the emissions scenario that the Independent Committee on Climate Change suggests the world is currently most closely following – and the 10%, 50% and 90% estimate ranges. These results should be considered alongside relevant research which is based on the climate change projections.	The High emissions scenario at 95th percentile has been used for sea level rise. For rainfall intensity the 50th percentile has been used, plus the 95th percentile as sensitivity.
	4.8.8	The IPC should be satisfied that there are not features of the design of new energy infrastructure critical to its operation which may be seriously affected by more radical changes to the climate beyond that projected in the latest set of UK climate projections, taking account of the latest credible scientific evidence on, for example, sea level rise (for example by referring to additional maximum credible scenarios – i.e. from the Intergovernmental Panel on Climate Change or EA) and that necessary action can be taken to ensure the operation of the infrastructure over its estimated lifetime.	At the end of the operational life of 40 years (around 2060) each site would be reviewed to see whether continued operation (and associated asset replacement) is required. In the event that the sites are still required, resilience and adaptive measures would be built in accordingly. Adaptive measures in the future will be driven by a combination of actual climate change and future flood and coastal risk management strategies and policies for the area. However, taking the H++ scenario gives levels 325mm higher than the UKCP09 High emissions, 95th percentile value by 2060. Three sites (Sandford, Bridgwater Tee and South of Mendips) are either resilient to this level or could be adpated in future through planned asset replacement. The fourth site (Seabank) has estimated levels conservatively up to 2073, with an additional 400mm freeboard for uncertainties. This covers the H++ scenario at present. For the Route FRA, the works are resilient to flooding even under the H++ scenario. Due consideration has therefore been given to the H++ scenario, and it is demonstrated that the Proposed Development is resilient to this scenario.
	4.8.9	Where energy infrastructure has safety critical elements (for example parts of new fossil fuel power stations or some electricity sub-stations), the applicant should apply the high emissions scenario (high impact, low likelihood) to those elements.	High emissions scenario has been applied. For sensitivity, H++ scenario has also been tested.

EN-1 - Overarching Energy

EN-1 Section	Para no.	Requirement as stated in the NPS	Compliance and Comment Related to the FRAs
	4.8.10	If any adaptation measures give rise to consequential impacts (for example on flooding, water resources or coastal change) the IPC should consider the impact of the latter in relation to the application as a whole and the impacts guidance set out in Part 5 of this NPS.	For all of the FRAs, none of the adaptation measures proposed give rise to consequential impacts elsewhere.
	4.8.11	Any adaptation measures should be based on the latest set of UK Climate Projections, the Government's latest UK Climate Change Risk Assessment, when available and in consultation with the EA.	The latest set of UK Climate projections have been used, as agreed in discussion with the EA. Adaptation measures and the adaptive management approach proposed are consistent with approaches outlined in the UK CCRA.
	4.8.12	Adaptation measures can be required to be implemented at the time of construction where necessary and appropriate to do so. However, where they are necessary to deal with the impact of climate change, and that measure would have an adverse effect on other aspects of the project and/or surrounding environment (for example coastal processes), the IPC may consider requiring the applicant to ensure that the adaptation measure could be implemented should the need arise, rather than at the outset of the development (for example increasing height of existing, or requiring new, sea walls).	All adaptation measures proposed are to be implemented at the time of construction to take account of climate change over the proposed lifetime of the development (40 years). In the event that the sites continue to be used beyond 40 years, further adaptive measures could be implemented. There are no adverse impacts of these measures on other apects of the project.
Flood Risk	5.7.4	Applications for energy projects of 1 hectare or greater in Flood Zone 1 in England or Zone A in Wales113 and all proposals for energy projects located in Flood Zones 2 and 3 in England or Zones B and C in Wales should be accompanied by a flood risk assessment (FRA).	FRAs have been completed for the following: (1) Bridgwater Tee CSE compound; (2) South of Mendip Hills CSE Compounds; (3) Sandford Substation; (4) Seabank Substation; (5) Hinkley C Connection Route FRA.
	5.7.5	The minimum requirements for FRAs are that they should:	See below:
	5.7.5	be proportionate to the risk and appropriate to the scale, nature and location of the project.	Each FRA is proportional to the risk with all sources of flooding addressed. The Route FRA has a specific detailed focus on flood risk during construction as this is different from flood risk during operation due to the presence of haul raods and other temporary works.
	5.7.5	consider the risk of flooding arising from the project in addition to the risk of flooding to the project	Each FRA consideres the risk <u>to</u> the development and the risk elsewhere resulting <u>from</u> the development.
	5.7.5	take the impacts of climate change into account, clearly stating the development lifetime over which the assessment has been made	Climate change impacts have been considered for sea level rise, increase in fluvial flows, and increase in rainfall intensity. The baseline assessment is for 40 years (the proposed operational life of the works) but with consideration to operation at the sites for an additional 20 years.
	5.7.5	be undertaken by competent people, as early as possible in the process of preparing the proposal	The FRAs have been undertaken by a competent framework supplier, with flood risk issues integrated into the process.
	5.7.5	consider both the potential adverse and beneficial effects of flood risk management infrastructure, including raised defences, flow channels, flood storage areas and other artificial features, together with the consequences of their failure	These factors are considered within the context of each FRA.
	5.7.5	consider the vulnerability of those using the site, including arrangements for safe access	Users have been considered, and safe access to and agress from the sites is considered as part of each FRA.
	5.7.5	consider and quantify the different types of flooding (whether from natural and human sources and including joint and cumulative effects) and identify flood risk reduction measures, so that assessments are fit for the purpose of the decisions being made	All sources of flooding have been considered - fluvial, tidal, pluvial (surface water), groundwater, sewers and water mains, reservoirs, canals and other artificial sources. Flood risk reduction (management) measures are considered for all FRAs to address all flood risks.
	5.7.5	consider the effects of a range of flooding events including extreme events on people, property, the natural and historic environment and river and coastal processes	Events considered range in severity from the 1 in 10 (10%) to 1 in 1000 (0.1%) annual probability event.

EN-1 - Overarching Energy

EN-1 Section	Para no.	Requirement as stated in the NPS	Compliance and Comment Related to the FRAs
	5.7.5	include the assessment of the remaining (known as 'residual') risk after risk reduction measures have been taken into account and demonstrate that this is acceptable for the particular project	Residual risk is addressed within the context of the flood risk management measures proposed.
	5.7.5	consider how the ability of water to soak into the ground may change with development, along with how the proposed layout of the project may affect drainage systems	Infiltration has been considered, and linked to design with permeable surfaces, and use of SuDS as part of the overall design. SuDS to be developed where applicable to maintain "greenfield" runoff rates as required.
	5.7.5	consider if there is a need to be safe and remain operational during a worst case flood event over the development's lifetime	All sites can remain operational during a major flood event. There is not a need for people to be located at the sites, and therefore, no need for access during a flood. This is demonstrated within each FRA for the specific conditions / requirements for each site.
	5.7.5	be supported by appropriate data and information, including historical information on previous events	A wide range of data sources is referred to, and data from the EA and Local Authority flood model outputs are used as part of the basis for design, in line with best practice. Flood history is researched for all sites and referenced where relevant. Specific reference is made to the January / February 2014 flood event on the Somerset Levels for those FRAs where this is relevant.
	5.7.6	Further guidance can be found in the Practice Guide which accompanies Planning Policy Statement 25 (PPS25), TAN15 for Wales or successor documents.	PPS 25 is no longer applicable. The current guidance for flood risk assessments is given in the Planning Practice Guidance (PPG) published on 6th March 2014 on Flood Risk and Coastal Change. Elements of the National Planning Policy Framework (NPPF) are also relevant, but the Technical Guidance which originally accompanied the NPPF is no longer valid. The suite of FRAs for the Proposed Development follow the guidance in the NPPF and PPG, as required within the NPS.
	5.7.7	Applicants for projects which may be affected by, or may add to, flood risk should arrange pre-application discussions with the EA, and, where relevant, other bodies such as Internal Drainage Boards, sewerage undertakers, navigation authorities, highways authorities and reservoir owners and operators. Such discussions should identify the likelihood and possible extent and nature of the flood risk, help scope the FRA, and identify the information that will be required by the IPC to reach a decision on the application when it is submitted.	Pre-application flood risk discussions have been held, and correspondence exchanged with EA, IDBs, and Local Authorities with specific regard to flood risk. Information from stakeholders has been used, and specific queries raised by stakeholders as part of the pre-application process have been addressed.
	5.7.8	If the EA has concerns about the proposal on flood risk grounds, the applicant should discuss these concerns with the EA and take all reasonable steps to agree ways in which the proposal might be amended, or additional information provided, which would satisfy the Environment Agency's concerns.	Various discussions and meetings have been held with the EA, plus an exchange of correspondence to identify specific concerns that the EA has, followed up with further discussions. The issues identified from these communications have been addressed.
	5.7.9	The IPC should be satisfied that where relevant:	See below:
	5.7.9	the application is supported by an appropriate FRA;	A series of five FRAs have been prepared in support of the DCO application.
	5.7.9	the Sequential Test has been applied as part of site selection	The Sequential Test has been applied to the route as a whole, and then to each site specific FRA within the context of the preferred route. The Sequential test Report is included as an Appendix to the Hinkley C Connection Route FRA.
	5.7.9	a sequential approach has been applied at the site level to minimise risk by directing the most vulnerable uses to areas of lowest flood risk	The sequential approach has been applied at a site level for each of the four site specific FRAs.
	5.7.9	the proposal is in line with any relevant national and local flood risk management strategy	All FRAs take account of national and local flood risk management strategies and plans. However, the continued operation of these plans and strategies has NOT been assumed, as it is recognised that these policies and plans could change over the lifetime of the Proposed Development.

EN-1 - Overarching Energy

EN-1 Section	Para no.	Requirement as stated in the NPS	Compliance and Comment Related to the FRAs
	5.7.9	priority has been given to the use of sustainable drainage systems (SuDs)	SuDS are proposed for those locations where the post-development runoff rate would otherwsie be increased above the greenfield runoff rate due to the Proposed Development.
	5.7.9	in flood risk areas the project is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed over the lifetime of the development.	Flood resilience and resistance measures are proposed as necessary at each site, including safe access and egress to and from the sites for maintenance, and escape from the sites in case of emergency. For the Route FRA this includes consideration of evacuation during the construction phase.
	5.7.10	For construction work which has drainage implications, approval for the project's drainage system will form part of the development consent issued by the IPC. The IPC will therefore need to be satisfied that the proposed drainage system complies with any National Standards published by Ministers under Paragraph 5(1) of Schedule 3 to the Flood and Water Management Act 2010. In addition, the development consent order, or any associated planning obligations, will need to make provision for the adoption and maintenance of any SuDS, including any necessary access rights to property. The IPC should be satisfied that the most appropriate body is being given the responsibility for maintaining any SuDS, taking into account the nature and security of the infrastructure on the proposed site. The responsible body could include, for example, the applicant, the landowner, the relevant local authority, or another body, such as an Internal Drainage Board.	There are no "final" National Standards yet published under this section of the Flood and Water Management Act. However, the proposed surface water drainage arrangements comply with the draft final guidance, published in January 2014. Any SuDS proposed would be maintained by National Grid. Active (intermittent) maintenance of SuDS would only be required at Sandford (attenuation pond) and at Seabank (on site drainage system).
	5.7.12	The IPC should not consent development in Flood Zone 2 in England or Zone B in Wales unless it is satisfied that the sequential test requirements have been met. It should not consent development in Flood Zone 3 or Zone C unless it is satisfied that the Sequential and Exception Test requirements have been met.	The requirements of the Sequential Test and the Exception Test are set out in each FRA. For each FRA, it is also demonstrated that the requirements of both tests (where appropriate) are met. All of the FRAs with the exception of Sandford require development in Flood Zone 3.
	5.7.13	Preference should be given to locating projects in Flood Zone 1 in England or Zone A in Wales. If there is no reasonably available site in Flood Zone 1 or Zone A, then projects can be located in Flood Zone 2 or Zone B. If there is no reasonably available site in Flood Zones 1 or 2 or Zones A & B, then nationally significant energy infrastructure projects can be located in Flood Zone 3 or Zone C subject to the Exception Test.	For all sites except Sandford, part of the works for the Proposed Development are required in Flood Zone 3. The Exception Test is required for these developments and this is set out within each FRA (except Sandford for which it is not needed).
	5.7.16	All three elements of the test will have to be passed for development to be consented. For the Exception Test to be passed:	See below:
	5.7.16	(1) it must be demonstrated that the project provides wider sustainability benefits to the community that outweigh flood risk	Confirmed for all FRAs on the basis of the need for the Proposed Developnment addressed elsewhere within the Environmental Statement.
	5.7.16	(2) the project should be on developable, previously developed land or, if it is not on previously developed land, that there are no reasonable alternative sites on developable previously developed land subject to any exceptions set out in the technology-specific NPSs	This requirement set out in the NPS refers to Planning Policy Statement 25 on Development and Flood Risk. PPS25 is now superseded, and the requirement is not identified in subsequent national planning policy, including both the NPPF (2012), and the recently published (March 6th 2014) Planning Practice Guidance. However, it is confirmed that there are no other previously developed sites that could be used, that have not been used. At Seabank, the proposal is to make use of the existing site for the substation amendments and extension i.e. making use of a previously developed site.
	5.7.16	(3) A FRA must demonstrate that the project will be safe, without increasing flood risk elsewhere subject to the exception below and, where possible, will reduce flood risk overall	All of the FRAs demonstrate that there is no quantifiable increase in flood risk elsewhere during operation. The Route FRA indicates that during construction there is a very minor increase in flood risk, although this is temporary (5 years). Mitigation measures are proposed to minimise this impact during the construction phase.

EN-1 - Overarching Energy

EN-1 Section	Para no.	Requirement as stated in the NPS	Compliance and Comment Related to the FRAs
	5.7.18 / 5.7.19	To satisfactorily manage flood risk, arrangements are required to manage surface water and the impact of the natural water cycle on people and property. In this NPS, the term Sustainable Drainage Systems (SuDS) refers to the whole range of sustainable approaches to surface water drainage management including, where appropriate: ● source control measures including rainwater recycling and drainage; ● infiltration devices to allow water to soak into the ground, that can include individual soakaways and communal facilities; ● filter strips and swales, which are vegetated features that hold and drain water downhill mimicking natural drainage patterns; ● filter drains and porous pavements to allow rainwater and run-off to infiltrate into permeable material below ground and provide storage if needed; ● basins ponds and tanks to hold excess water after rain and allow controlled discharge that avoids flooding; and ● flood routes to carry and direct excess water through developments to minimise the impact of severe rainfall flooding.	Surface water management is included within all FRAs, covering both the impact on the development and the impact resulting from the development. This follows SuDS principles and meets the requirements of the draft national Standards on drainage arrangements as prespared under the Flood and Water Management Act 2010. Within different FRAs, various of the measures outlined within the NPS are included as part of the SuDS approach.
	5.7.20	Site layout and surface water drainage systems should cope with events that exceed the design capacity of the system, so that excess water can be safely stored on or conveyed from the site without adverse impacts.	All sites can appropriately deal with over design flood events without additional adverse impact.
	5.7.21	The surface water drainage arrangements for any project should be such that the volumes and peak flow rates of surface water leaving the site are no greater than the rates prior to the proposed project, unless specific off-site arrangements are made and result in the same net effect.	For all sites, greenfield runoff rates would be maintained from the pre-development condition.
	5.7.22	It may be necessary to provide surface water storage and infiltration to limit and reduce both the peak rate of discharge from the site and the total volume discharged from the site. There may be circumstances where it is appropriate for infiltration facilities or attenuation storage to be provided outside the project site, if necessary through the use of a planning obligation.	Within various FRAs, surface water storage and/or infiltration is proposed. All of these measures proposed are within the project site boundaries.
	5.7.23	The sequential approach should be applied to the layout and design of the project. More vulnerable uses should be located on parts of the site at lower probability and residual risk of flooding. Applicants should seek opportunities to use open space for multiple purposes such as amenity, wildlife habitat and flood storage uses. Opportunities should be taken to lower flood risk by reducing the built footprint of previously developed sites and using SuDS.	The sequential approach has been considered at a site level, although it should be noted that because all of the sites within Flood Zone 3 are very flat, there is no quanitifiable difference in flood risk across the sites. Opportunities have been taken for flood storage and habitat enhancement at Sandford. At those sites (including parts of the Route FRA, e.g. site compounds) where flood risk could potentially be adversely affected, SuDS are proposed. At previously developed sites (only applies to Seabank) the built "impermeable" footprint is reduced to balance the new impermeable areas to be added.

EN-1 - Overarching Energy

EN-1 Section	Para no.	Requirement as stated in the NPS	Compliance and Comment Related to the FRAs
	5.7.24	Essential energy infrastructure which has to be located in flood risk areas should be designed to remain operational when floods occur. In addition, any energy projects proposed in Flood Zone 3b the Functional Floodplain (where water has to flow or be stored in times of flood), or Zone C2 in Wales, should only be permitted if the development will not result in a net loss of floodplain storage, and will not impede water flows.	All of the infrastructure for which the FRAs have been developed is classified as "Essential Infrastructure". It has all been designed to remain operational during a flood. This includes allowing flooding across the CSE compound sites without affecting operation as the water sensitive equipment would all be elevated above the appropriate extreme design flood level. For those aspects of the Proposed Development located in Flood Zone 3b (primarily linked to aspects of the route FRA such as pylons and underground cables) there is no net loss of flood plain storage, nor any impedance to flood flows following completion of construction. During construction for the route FRA, there is a very small loss of storage, but this is temporary, and negligible compared to the total flood plain storage volume. Mitigation measures are proposed that signficantly limit any potential impacts.
	5.7.25	The receipt of and response to warnings of floods is an essential element in the management of the residual risk of flooding. Flood Warning and evacuation plans should be in place for those areas at an identified risk of flooding. The applicant should take advice from the emergency services when producing an evacuation plan for a manned energy project as part of the FRA. Any emergency planning documents, flood warning and evacuation procedures that are required should be identified in the FRA.	For all sites that are located within flood warning areas, the FRAs recommend that the sites would be signed up to the Environment Agency Flood Warnings Direct service. There are no (generally) manned sites for the Proposed Development. Evacuation plans are recommended within the FRAs, to be developed prior to the start of operations at the various sites. For the route FRA, where construction is required across extensive lengths of flood plain, an evacuation plan is recommended, linked to the provision of flood warnings for the areas located within the flood plain. All FRAs outline evacuation routes, flood warning requirements, and the need for evacuation plans to be developed.

NPS Requirements and Compliance

EN-5 - Electricity Networks Infrastructure

EN-5 Section	Para no.	Requirement as stated in the NPS	Compliance and Comment Related to the FRAs
Climate Change Adaptation	2.4.1	Applicants should set out to what extent the proposed development is expected to be vulnerable, and, as appropriate, how it would be resilient to: flooding, particularly for substations that are vital for the electricity transmission and distribution network; effects of wind and storms on overhead lines; higher average temperatures leading to increased transmission losses; and earth movement or subsidence caused by flooding or drought (for underground cables).	Resilience of the Proposed Development to flooding is discussed in the following FRAs: (1) Bridgwater Tee CSE Compounds; (2) South of Mendips CSE compound; (3) Sandford Substation; (4) Seabank Substation amendments and extension; (5) Hinkley C Connection Route FRA. Resilience of the Proposed Development to other potential effects of Climate Change are discussed in the Planning Statement.
	2.4.2	Section 4.8 of EN-1 advises that the resilience of the project to climate change should be assessed in the Environmental Statement (ES) accompanying an application. For example, future increased risk of flooding would be covered in any flood risk assessment (see Section 5.7 in EN-1).	The ES takes Climate Change into account in each of the topic assessments.