A17/2b - Volume 2b: Technical Report: Surface Water and Flood Risk

Transport and Works Act 1992

Boston Barrier Order

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We protect and improve the quality of water, making sure there is enough for people, businesses, agriculture and the environment. Our work helps to ensure people can enjoy the water environment through angling and navigation.

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Quality Assurance

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Approvals

Name	*Title*	*Date*	*Version*
EW	*Water and Flood Manager*	*12/08/2016*	*1*
EL	*EIA Project Director*	*12/08/2016*	*1*

EIA Quality Mark

This Environmental Statement, and the Environmental Impact Assessment (EIA) carried out to identify the significant environmental effects of the proposed development, was undertaken in line with the EIA Quality Mark Commitments.

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EIA Content
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Contents

Appendices 29

Tables

1 Introduction

1.1 Overview

1.1.1 This Report forms part of the Technical Reports (Volume 2a – 2d) that support the Boston Barrier Project Environmental Statement (ES) (Volume 1). Volume 2 reports the EIA for the Project, identifying all the predicted effects, irrespective of their significance. Whereas Volume 1 discusses only those effects, both temporary and permanent, deemed significant under the EIA regulations.

1.2 The Project

1.2.1 The purpose of the Project is to improve the standard of protection from tidal flooding. The proposals would not affect the existing standards of fluvial flood protection provided upstream within the River Witham and South Forty Foot Drain (SFFD). In January 2015 water level management (WLM) was removed from the scope of this current Project. In making the decision, the Environment Agency, Lincolnshire County Council (LCC) and Boston Borough Council (BBC) confirmed that it remains the vision to provide WLM at a later date through a standalone project and consenting process.

1.2.2 The Project would connect to the existing defences downstream of the town. The Project would consist of water-based works (the barrier structure) and land-based work (along the Haven).

1.2.3 Defences immediately downstream of the barrier structure would be improved to a 1 in 300 standard of protection as a part of the barrier structure works. This level of protection is to ensure protection against a 0.33% (1 in 300) annual probability of flooding over the 100 year project life.

1.2.4 The Project would be constructed south of the town of Boston across the area of the River Witham known as 'the Haven' (see ES (Volume 1): Appendix A; Figure 1.1). It would be approximately 100m downstream of Black Sluice, adjacent to the Starch Berth (on the Port of Boston (PoB) estate - left bank) and existing residential properties (along Wyberton Low Road - right bank).

1.2.5 It should be noted that, references to left and right bank of the Haven are described in a downstream facing direction. Therefore, the left bank (north side) is on the left side when facing downstream and the right bank (south side) is on the right side when facing downstream.

1.2.6 A detailed description of the project is included in the ES (Volume 1): Chapter 2.

1.3 Purpose of assessment

1.3.1 This purpose of this assessment is to consider the surface water baseline relevant to the Project and the potential significant issues scoped in as part of the Project's Updated Scoping Report (Environment Agency, 2014a) outlined in Section 2.6 of this Report). The assessment includes consideration of the risks to surface water quality associated with sediment re-suspension during dredging (construction phase). The assessment identifies the predicted impacts and proposes management and mitigation to minimise predicted impacts including residual effects.

1.3.2 Impacts of the Project on flooding are discussed in a separate Project Flood Risk Assessment (see ES (Volume 2c)). A preliminary Water Framework Directive (WFD) compliance assessment can be found in Appendix B of this Report.

1.3.3 Groundwater quality issues related to dredging (and to piling) are addressed in the ES (see ES (Volume 1): Chapter 12).

1.4 Report structure

1.4.1 This Report comprises the following key sections:

- Methodology: Outlines the methodology used to carry out the assessment;
- Legislation and planning policy: Outlines the key legislation and policies relevant to the area and to the Project;
- Baseline conditions: Presents the baseline scenario and current local environmental conditions including data on surface water classification, water quality (including sediment and salinity conditions and surface water flows (where known);
- Impact assessment: Provides a high level description of key construction and operational activities which have implications on surrounding surface water elements;
- Mitigation: Sets out the likely effects on the local and wider surface water environment during construction and operation following the implementation of appropriate mitigation measures;
- Summary: Describes the predicted significant residual effects following the implementation of mitigation measures and the extent to which the Project complies with planning and relevant policy; and
- References: Contains the references and source materials relating to the surface water assessment.

2 Assessment methodology

2.1 Sources of information

2.1.1 Desk study information on water resources within the study area has been obtained from the following sources:

- Environment Agency (2015), What's in Your Backyard, Available at: http://maps.environment-agency.gov.uk/wiyby/wiybyController?x=357683&y=355134&scale=1&layerGroups=default&ep=map&textonly=off&lang=_e&topic=wfd_rivers, [Accessed: March 2015]; and
- Landmark Group (2014), Envirocheck Report National Grid Reference: 533190, 342920, December 2014;
- UK, Environment Agency (2014a) "Marine Monitoring Report";
- UK, Environment Agency (2014b) "Boston Barrier, Updated Scoping Report";
- UK, Halcrow Jacobs A "Boston Barrier and Haven Works, Water Quality and Sediment Chemistry" Technical Note (2011); and
- UK, WYG Environment (2015), "Boston Barrier Phase 3 Final Factual Ground Investigation Report".

2.2 Water quality surveys

2.2.1 A water quality survey programme was carried out along a 3.5km stretch of The Haven, downstream of Boston. The survey took place between spring 2010 and winter 2011. A technical note detailing the findings of the survey was presented in the Water Quality and Sediment Chemistry Technical Note (Halcrow Jacobs Alliance (HJA), March 2011).

2.2.2 The main aim of the survey was to identify any existing pollutants or sources of contamination that may affect the design of the barrier. No further water or sediment quality sampling has been carried out since this date specifically for the Project. Existing data, combined with routine monitoring is considered to give an adequate basis on which to undertake the impact assessment as no significant changes are expected since the original survey work. A summary of these results was also set out in a Marine Monitoring Report produced by the Environment Agency in 2014 (Environment Agency, 2014b).

2.2.3 Following the baseline water quality surveys, the Estuarine and Coastal Monitoring and Assessment Service (ECMAS) carried out routine additional monthly sampling work from August 2013. The samples tested for the following:

- Dissolved nutrients;
- Chlorophyll and phytoplankton;
- Physicochemical – suspended solids, salinity, dissolved oxygen and temperature;
- Dissolved Metals – Lead, Arsenic, Mercury, Zinc, Cadmium, Chromium, Copper and Nickel; and
- Organotin.

2.2.4 Quarterly data is also being collected for Biological Oxygen Demand (BOD) and a targeted Gas Chromatography–Mass Spectrometry (GCMS) scan. GCMS is a method used to identify different substances within a test sample. The results of the scan are only semi-quantitative and the detection levels are not as precise as other measurement techniques. However, it is used to look for peak concentrations of a broad range of organic compounds and then to identify them.

2.3 Consultation

2.3.1 A high level technical workshop with stakeholders was held in February 2011 to consider and discuss the potential implications of the Water Framework Directive (WFD) for the Project. This was for an alternative scheme design, which included water level management (WLM). However, WLM has now been removed from the Project design for reasons set out in ES (Volume 1): Chapter 3. The initial 'screening' exercise carried out at the workshop is still considered valid and the focus of the preliminary WFD compliance assessment and this chapter will assess the potential impact of the Project on four water bodies: Witham Transitional, Lower Witham, SFFD and the Wash (inner). However, it is noted that while still valid, some aspects originally screened as relevant to WFD interests are now no longer of interest due to the removal of WLM. Where this is the case, justification is provided within the text.

2.4 Study area

2.4.1 The study area for this topic covers the whole of the Haven (the Witham Transitional water body, which has been scoped in to the WFD assessment). Water bodies are shown in Appendix A of this Report: Figure 2.1. Upstream water bodies are unlikely to be affected due to the presence of sluices. Downstream water bodies are unlikely to be affected as any significant change to the quantity or quality of water would be undetectable in the larger downstream water bodies (such as The Wash).

2.5 Scoping assessment

2.5.1 The scoping process for this Project was undertaken using professional judgement, based on our understanding of the baseline environmental conditions and the methods in which the Project would be constructed and operated. Those issues identified as likely to result in a significant effect were highlighted in the Updated Scoping Report (Environment Agency, 2014) and have been taken forward for further consideration within this ES and they are listed below.

- Surface water:
  - Potential for a change in water quality as a result of sediment-bound contaminants being mobilised into the water column during construction;
  - Potential for a change in water quality as a result of increase in suspended sediment within the water column during construction; and

  - Potential for a change in flood risk as a result of alterations to the existing flow regime.
- Water Framework Directive:
  - The potential effect of the Project on the elements of those water bodies which have been scoped into the WFD assessment (see Appendix B of this Report).

2.6 Assessment methodology

2.6.1 The methodology used to assess the significance of impacts follows an industry standard approach, described in Table 2.1 and Table 2.2 below.

Table 2.1: Description of the EIA process

Stage	Description
Stage 1: Determine the value/sensitivity of the receptors/ environmental resource	Identify baseline conditions within a defined study area. The baseline will be the conditions expected to be present in the study area immediately prior to the proposed construction of the project. List receptors (e.g. people) and environmental resources (e.g. elements of the existing natural or built environment) within a defined study area. Assess the value of each environmental resource and / or assess the sensitivity of each environmental receptor according to a five-point scale (i.e. very high, high, medium, low and negligible). Criteria defining these values will differ with respect to each topic area, and are presented below.
Stage 2: Determine the magnitude and characteristics of impacts	Identify the known or likely impacts (e.g. physical changes) of the works on receptors or environmental resources at the pre-construction, construction and post construction / operational phase, relative to the baseline conditions. Describe the nature (negative or positive) and characteristics (i.e. whether direct or indirect, secondary, cumulative, short or long-term, permanent or temporary, reversible or irreversible) of these impacts. Consider the characteristics of each impact to determine its magnitude. Classify the magnitude of the impacts as negligible, minor, moderate or major, and positive or negative. Criteria defining the magnitude of impacts will differ with respect to each topic area and are presented below.
Stage 3: Determine the significance of the effect	Evaluate the significance of the environmental effect based on the value or sensitivity of the receptor and/or environmental resource and the characteristics of the impact using the criteria in Table 6. Where the table presents two options for significance, for example minor adverse/moderate adverse, one of these will be chosen using professional judgement, and the reason will be provided.
Stage 4: Identify mitigation measures	Where significant (i.e. moderate or major) adverse effects are predicted, recommend measures to avoid (e.g. via changes to the design of the project), mitigate (e.g. reduce the impacts on site) or remedy, which could include compensation (e.g. replacement elsewhere), those effects.
Stage 5: Determine the significant of residual effects	Re-classify the impact using the same criteria used in Stages 1 to 3 to determine the significance of environmental effects that would occur after the proposed mitigation measures have taken effect.
Stage 6: Identify cumulative effects	Cumulative effects may arise from our project in combination with other projects proposed in the same area. We will identify such projects and include an assessment of cumulative effects in our EIA.

Source: Mott MacDonald 2016

2.6.2 Table 2.4 sets out the matrix that will be used in the EIA for evaluating the significance of environmental effects.

2.7 Impact assessment

2.7.1 The significance of potential impacts is assessed by evaluating the sensitivity of the baseline environment and the potential magnitude of the predicted impact.

Sensitivity/value

2.7.2 The sensitivity of the baseline environment to each impact has been assessed using a combination of professional judgement and predefined criteria, categorised as being high, moderate, low or not sensitive. Receptors only need to meet one of the defined criteria to be categorised at the associated level of sensitivity.

Table 2.2: Definitions used to classify the sensitivity of receptors

Receptor Sensitivity	Definition
Very high	Receptor is of high international ecological value and exhibits a strong hydrological dependence. Receptor is a critical national asset.
High	Receptor is of high ecological importance national or international value and has a strong hydrological dependence Receptor has an overall WFD status/potential of ‘Good’ or ‘High’ Receptor is a public or private water supply Receptor is at high risk from flooding
Medium	Receptor is at moderate risk from flooding but does not act as an active floodplain Receptor has an overall WFD status/potential of ‘Moderate’
Low	Receptor is at low risk from flooding Receptor is not used for any water supply Receptor has an overall WFD status/potential of ‘Poor’ or ‘Bad’ Soil type of receptor is not sensitive to changes in the hydrological regime
Not sensitive	Receptor lies outside the sphere of influence of the proposed development

Source: Mott MacDonald 2016

2.7.3 While the WFD status forms part of the basis for assessing sensitivity, compliance with the WFD itself is assessed separately (see Appendix B of this Report).

Magnitude

2.7.4 The magnitude of a potential impact would depend upon whether the impact would cause a fundamental, material or detectable change. The criteria for assessing the magnitude of potential impacts are categorised as being major, medium, low or negligible and are outlined in Table 2.3 below. Impact magnitude can be categorised as negative or positive.

2.7.5 Probability, duration and proximity to infrastructure would be considered where they influence the magnitude of an impact.

Table 2.3: Definitions of effect magnitude

Magnitude of impact	Definition
Major	Total loss of, or alteration of, key features of the baseline environment such that post-development characteristics or quality would be fundamentally or irreversible changed.
Moderate	Loss of, or material change to, key features of the baseline resource such that post-development characteristics or quality would be materially changed.
Minor	Small changes to the baseline resource such that post development characteristics or quality would be materially changed.
Negligible	A very slight change from baseline conditions which is barely distinguishable, and approximates the 'no change' situation. These changes are close to or below the limit of detection.

Source: Mott MacDonald 2016

Significance

2.7.6 The significance of a potential impact is defined by the sensitivity of the receiving water environment (the receptor) and the magnitude of the potential impact. Table 2.4 provides a description of how significance is judged from the combination of sensitivity and magnitude. In some cases, magnitude or sensitivity cannot be quantified with certainty, and in these cases professional judgement remains the most effective way to identify the significance of an impact. Where this is necessary it would be highlighted within the text and full justification presented.

2.7.7 Where the significance of an effect is 'major' or 'moderate', mitigation is required in order to reduce impacts to an acceptable level. Only impacts which are 'moderate' or 'major' after mitigation are considered to be residual significant effects under the EIA Directive.

Table 2.4: Significance matrix

Magnitude and nature of impact	Value / Sensitivity			
	Very High	High	Medium	Low
Major negative	Major adverse	Moderate adverse / Major adverse	Moderate adverse	Minor adverse / Moderate adverse
Moderate negative	Moderate adverse / Major adverse	Moderate adverse	Minor adverse / Moderate adverse	Minor adverse
Minor negative	Minor adverse / Moderate adverse	Minor adverse / Moderate adverse	Minor adverse	Minor adverse
Negligible	Negligible / Insignificant			

Magnitude and nature of impact	Value / Sensitivity			
	Very High	High	Medium	Low
Minor positive	Minor beneficial / Moderate beneficial	Minor beneficial / Moderate beneficial	Minor beneficial	Minor beneficial
Moderate positive	Moderate beneficial / Major beneficial	Moderate beneficial	Minor beneficial / Moderate beneficial	Minor beneficial
Major positive	Major beneficial	Moderate beneficial / Major beneficial	Moderate beneficial	Minor beneficial / Moderate beneficial

Source: Mott MacDonald 2016

2.8 Flood risk assessment

2.8.1 A National Planning Policy Framework (NPPF) compliant flood risk assessment (FRA) of the Project has been carried out to confirm that the Project meets its objectives in relation to flood risk management. The outcomes of the FRA are reported separately within a standalone Report (see ES (Volume 2c): Flood Risk Assessment) which supports the Transport and Works Act Order (TWAO). A hydraulic model was used to simulate both fluvial and tidal events for the existing, construction and operational scenarios as well as to simulate the impacts of predicted climate change. The results were then used to determine the impact on tidal and fluvial flood risk.

2.8.2 The results of the modelling for tidal flood risk indicated that, on completion of the barrier construction, the risk from tidal flooding would be significantly reduced. There is no substantial change in the water levels within the Haven downstream of the barrier once complete for the tidal flood events that were modelled.

2.8.3 The modelling results for fluvial flood risk predicted that the barrier would not increase fluvial flood risk to Boston town as it does not significantly restrict conveyance. It is predicted to extend the period of tide-locking on the Lower Witham and South Forty Foot Drain by an additional 30-40 minutes during fluvial events due to the small increase in water level upstream of the barrier. The model also predicts that the barrier would not significantly increase fluvial flood risk on the River Witham and South Forty Foot Drain fluvial flood event under existing conditions nor when considering climate change in the next 100 years.

2.8.4 The FRA concludes that: *“the development is water compatible and is therefore not considered at risk from flooding. It is recommended that during the construction workers are made aware that they are working within an area at risk from tidal flooding. During construction, it would be prudent to maintain the current flood warning for Boston because the upper Haven remains at risk from overtopping during tidal flood event until the Boston Barrier is operational.”*

3 Legislation and planning policy

3.1 Legislative requirements

European Union legislation

3.1.1 The Water Framework Directive (WFD) is European Union (EU) legislation implemented in England and Wales by The Water Environment (Water Framework Directive) (England and Wales) Regulations SI 3242 / 2003. It is the principal means by which EU member states' environmental regulation is harmonised, and it superseded several water related directives.

3.1.2 The WFD requires EU member states to prevent deterioration in the ecological and chemical status of surface water bodies and to aim to improve the status of water bodies which are at less than good status. In WFD terms, an impact is 'significant' if it has a non-temporary effect on status at water body level: in other words, if it causes deterioration in the status class of the water body in respect of one or more WFD parameters or if it prevents that water body from achieving its WFD objective (usually good status or good potential).

3.1.3 A project is compliant with the WFD if there are no 'non-temporary effects on status at water body level'. There are very few exceptions under the WFD. However, if the deterioration or failure to meet good ecological status is a result of a new physical modification supporting sustainable development, the tests set out under Article 4(7) of the WFD can be applied and an exemption may be granted.

3.1.4 Where projects have the potential to alter the hydromorphology or other characteristics of a water body in such a way as to affect its ecological quality, the WFD requires the works to be undertaken in the most environmentally sensitive manner, within the constraints of technical feasibility and cost. The focus is on achieving as a minimum, 'good' potential in every HMWB water body, with this objective being dependent on achieving as a minimum 'good' chemical status and good ecological status (including adjacent water bodies).

3.1.5 A WFD compliance assessment has been undertaken to assess whether the Project is compliant with Water Framework Directive objectives. This has concluded that the Project is compliant. Justification for this conclusion can be found in the WFD compliance assessment which is contained within Appendix B of this Report.

National legislation

3.1.6 Water resources are managed and protected under United Kingdom legislation and regulations consistent with EU Directives. In relation to the Project, the relevant legislative framework includes the following:

- Water Resources Act 1991 as amended by the Water Act 2014 (previously Water Act 2003), which sets out provisions for the control of pollution of water;
- Environment Act 1995, which also sets out provisions for the control of pollution of water and the requirement for the EA to improve the environment; and

- Flood and Water Management Act 2010 that sets out provisions for the management of risks associated with flooding and coastal erosion.

3.2 National planning policy

National Planning Policy Framework

3.2.1 The main sections of the NPPF of relevance to the management and protection of surface waters include:

- Chapter 10: Meeting the challenge of climate change, flooding and coastal change; and
- Chapter 11: Conserving and enhancing the natural environment.

3.3 Local planning policy

3.3.1 The Boston Borough Local Plan (1999) sets out the planning policies and proposals for the Boston Borough.

3.3.2 Item G4 of the local plan states planning permission will not be granted for developments which would have an adverse effect on the water environment, or the quality of surface or groundwater. Contamination of the surface and groundwater must be prevented to protect these resources.

3.4 South East Lincolnshire Local Plan 2011-2036

3.4.1 It has been noted that the South East Lincolnshire Local Plan 2011-2036 was submitted as a draft for Public Consultation between January and April 2016. As this Plan is still a draft, it currently carries a limited material weight when considering how developments meet planning policy, but reference the polices relevant to this Report are outlined below:

- Policy 4: Strategic approach to Flood Risk.

3.5 Guidance

3.5.1 Guidance of relevance to managing surface water quality includes:

- Environmental good practice on site (CIRIA, 3rd Edition, 2010);
- Control of water pollution from construction sites - guide to good practice (CIRIA, 2002);
- Environment Agency Pollution Prevention Guidelines (PPG), in particular:
  - PPG1 - Understanding your environmental responsibilities - good environmental practices;
  - PPG2 - Above ground oil storage tanks;
  - PPG3 - Use and design of oil separators in surface water drainage systems;
  - PPG5 - Works and maintenance in or near water;
  - PPG6 - Working at construction and demolition sites;
  - PPG21 - Incident Response Planning; and
  - PPG22 - Dealing with spills.

4 Baseline conditions

4.1 The Haven

4.1.1 The Anglian River Basin Management Plan (RBMP) classifies The Haven ("Witham Transitional") (Water body ID GB530503000100) as a Heavily Modified Water Body (HMWB) with moderate ecological potential. There are a number of existing hydromorphological pressures within The Haven/Witham Transitional including land reclaim, bank reinforcement, channel dredging, tidal river channelization/realignment/straightening and construction.

4.1.2 The WFD requires all HMWB to achieve Good Ecological Potential (GEP). It is expected that the Witham Transitional water body will achieve GEP by 2027 as it was considered to be disproportionately expensive and/or technically unfeasible to achieve GEP by 2015. To achieve GEP, six specific mitigation measures must be in place and functioning (RBMP, Annex B, 2009, p1416). At present, all the mitigation measures are in place along the water body and relate to reducing the impact of dredging through altering the timing and disposal thereof, setting out a strategy to avoid the need to dredge and seeking opportunities for bank rehabilitation and re-profiling. At the time of undertaking this assessment, the second cycle RBMP's had not been finalised and so the 2009 RBMP's have been used as the basis for assessment. However, following the publication of the second cycle, the 2009 classification has been cross-checked against the 2015 classification. Changes to individual WFD elements from the 2009 classification are noted in the 'Baseline Conditions' section, however, the classification of individual elements has not changed significantly. Some information on the Mitigation Measures element were lacking from the 2015 RBMP dataset. While this represents an information gap the findings of the WFD assessment are not sensitive to this element and the differences have been carried through into this assessment.

4.1.3 A detailed account of existing quality based on individual quality elements under WFD and of these mitigation measures are provided in a preliminary WFD compliance assessment report (see Appendix B of this Report).

4.1.4 The water and sediment sampling carried out within the Witham estuary in 2010/2011 is provided in Appendix C of this Report. The survey results identified good water quality for all sites, with only one single exceedance of the Environmental Quality Standard for Iron at Site 2 (downstream of confluence with SFFD). The survey concluded that physiochemical parameters were within expected levels. Depressed salinities recorded over the winter months are likely to have been caused by increased freshwater flows, preceding the survey times.

4.1.5 Three intertidal and three sub-tidal sediment samples were collected within The Haven in 2010/2011 (HJA, 2011). Sediment chemistry analysis at each site was undertaken. The nearest sample site to the proposed works (named "Upstream of the Docks" in HJA Report, 2011) is located where dredging works are proposed during construction and operation of the Wet Dock Gate. The sediment analysis was compared with Threshold Effect Levels (TEL – Concentrations below which contaminants are not considered to represent significant hazards to the aquatic environment) and Probable Effect Levels (PEL – lowest concentration of a substance that is known to have an adverse effect on the aquatic environment) of the Environment Canada (CCME, 1999) guidelines to assess potential impacts to the aquatic environment. The results concluded that no PELs were exceeded in the sediment chemistry analysis, although arsenic, chromium, copper, lead, nickel and zinc TELs were exceeded, principally at sites with a predominance of fine sediments. This level of sediment contamination is expected in an estuary with a working dock and associated history.

4.1.6 During the 2014 ground investigation (WYG Environment, 2014), sediment sampling was undertaken at eight locations within the River Witham. The samples were taken in order to determine the potential for use or requirement for disposal of the dredged sediment during construction. The results are provided in Appendix C of this Report. The ES (Volume 2b): Contaminated Land Technical Report contains a summary of the findings of the 2010 and 2014 surveys.

4.1.7 Both surveys noted that elevated levels of arsenic, chromium, nickel, lead, zinc and Polyaromatic Hydrocarbons (PAHs) were measured at differing degrees and sites as summarised in the ES (Volume 1): Chapter 12.

4.2 The Lower Witham

4.2.1 The Lower Witham joins the Witham Transitional upstream of the PoB through the Grand Sluice. The Lower Witham (Water body ID GB105030062420) is classified under the WFD as a HMWB for the purposes of agricultural drainage and recreational navigation; it has been straightened and re-sectioned along its 67.7km length. Its current status is of moderate ecological potential. The status objectives are to reach GEP by 2027 and Good Chemical Status by 2015. The moderate status is due to the current moderate status for phytobenthos, macrophytes and phosphate concentrations.

4.2.2 The quantity and dynamics of flow of the Lower Witham are strongly influenced by Bardney Lock, Boston Grand Sluice Lock and the very low gradient of the water body. It is a straight planform water body with a low gradient and it exhibits limited flow range and low morphological diversity.

4.2.3 The current status of the salinity quality element has not been classified. There is known to be a degree of saline water leakage from the Witham Transitional into the Lower Witham through Grand Sluice.

4.2.4 Several mitigation measures are set for this water body, with a proportion already in place. These are set out in more detail in the WFD assessment report (Appendix B of this Report). Some measures relate to sediment (dredging) which may be of relevance to this assessment and are also reported on in the preliminary WFD assessment.

4.2.5 No additional water or sediment quality data has been collected for the Project within this water body as neither are likely to be affected by the Project. The Project would not affect the water resources of the Lower Witham.

4.3 South Forty Foot Drain

4.3.1 The SFFD is connected to the Witham Transitional via the Black Sluice. It has been discounted from this assessment as Black Sluice acts as an effective barrier to flow upstream, effectively blocking any temporary impacts from construction or operation of the Project from being detectable within this waterbody. Due to the temporary effect the barrier structure would have during operation, and the existence of Black Sluice, there is no justification for assuming any operational effects on this waterbody.

4.4 The Wash (Inner)

4.4.1 The Wash (inner) has been excluded from this assessment. Any impacts on the Witham Transitional water body are predicted to be minor and so no change would be detectable on The Wash (inner) water body. On this basis The Wash (inner) is excluded from the assessment.

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5 Impact assessment

5.1 Introduction

5.1.1 The predicted effects of the Project on surface water are addressed in this section. The assessment is split into two sections; construction effects and operational effects.

5.1.2 The predicted construction effects will assess the proposed works to be carried out in or near the water environment. The predicted operational effects will assess the effects on surface water through the operation of the Project.

5.2 Construction

Assessment assumptions and limitations

5.2.1 This assessment has been based upon existing baseline information and the proposed barrier design. As far as is known, there are no significant gaps in information which materially affect this impact assessment.

5.2.2 The natural environment is inherently dynamic and subject to constant change. While objective assessment and professional judgement have been used to assess potential impacts, actual impacts may differ from those predicted.

5.2.3 Due to the presence of both Black Sluice and Grand Sluice, construction and operational effects are only anticipated on the Witham Transitional. As such, it is the only surface water body considered within this assessment. Due to its moderate WFD status and the fact that there are no sensitive water dependent ecological receptors, this water body has been classified as having moderate sensitivity, as it is able to absorb some degree of change.

5.2.4 The following assumptions have been made:

- Construction would be carried out in line with best practice;
- Works to the Wet Dock Gate would involve 24/7 construction;
- Dredging would occur on low tides and may be carried out twice a day for approximately 6 weeks. Dredging would primarily occur between mid-October and mid-March, but would avoid periods of smelt spawning between mid-February and mid-March, depending on water temperature being a minimum of 9.0 degrees Celsius;
- Total dredged volumes of material would approximate 38,300m^3 of material;
- Dredging would primarily occur outside the cofferdam; and
- Normal tidal activity would continue in The Haven during the construction period.

5.2.5 Construction best practice would be adopted at all times. This would involve adherence to standard industry guidance which includes (but is not limited to) Pollution Prevention Guidelines (PPG), jointly published by UK environment agencies as well as CIRIA guidance on good site practice. This assessment assumes that best practice, defined as site practices that would typically be expected on a UK construction site, is implemented.

5.2.6 Best practice guidance would be implemented in order to deal with the following risks to the surface water environment:

- The set up and management of construction compounds and materials storage areas;
- Sediment management for works within/adjacent to the water environment;
- Storage of fuels, oils and other chemicals;
- Dust suppression;
- Management of run-off from exposed/excavated areas; and
- Measures to deal with accidental spillages or sabotage of plant.

5.3 Construction impact assessment

5.3.1 The principal construction activities with the potential to impact the surface water environment relate to works undertaken in or near the water environment. The Project elements which may result in effects on the surface water environment include:

- Installation and removal of coffer dams (including associated dredging) for barrier construction, impacting turbidity levels in the water body;
- Works on the Wet Dock Entrance and new gate;
- Installation of scour protection;
- Excavations required for in river works and barrier tie in walls;
- Construction of the barrier; and
- Runoff from temporary access roads and other hardstanding.

5.3.2 Construction impacts may have a temporary or permanent effect. These are listed in Table 5.1.

Table 5.1: Summary of impacts during construction

Receptor/ Baseline Asset	Description of issue	Value/ Importance	Magnitude of impact	Significance
Witham Transitional, downstream of Grand Sluice	Increases in turbidity from dredging/excavation works	Medium	Minor negative, as baseline turbidity levels can be considered relatively high and increases should be temporary and flushing would occur.	Minor adverse
Witham Transitional, downstream of Grand Sluice	Mobilisation of sediment bound contaminants (including nutrients) into the water column	Medium	Minor negative, as mobilisation would only occur for short periods and regular flushing would occur through tidal exchange. Impact managed through production and implementation of method statements for dredging.	Minor adverse
Witham Transitional, downstream of Grand Sluice	Pollution from oil/fuel/chemical spillage	Medium	Minor negative, assuming best practice measures are followed as extent should be minor and should be short duration only.	Minor adverse

Receptor/ Baseline Asset	Description of issue	Value/ Importance	Magnitude of impact	Significance
Witham Transitional, downstream of Grand Sluice	Pollution from silt laden runoff	Medium	Minor negative.	Minor adverse
Witham Transitional, downstream of Grand Sluice	Flood risk during construction (to workforce)	Medium	Minor negative	Minor adverse

Source: Mott MacDonald 2016

5.3.3 No significant impacts during the construction phase are predicted.

Flood Risk Assessment

Impact of Project on tidal flood risk during construction

5.3.4 Under the construction scenario, there is a slight reduction in flood extent for upstream areas in all tidal flood events modelled (see ES (Volume 2c): Flood Risk Assessment; Figure 2.4). The assumed cofferdam during the construction scenario restricts the incoming tide which lowers the maximum levels in the Haven upstream. As a result, maximum flood depths and velocities are slightly reduced in these upstream locations. However, Boston town remains at risk of tidal flooding until the barrier gate is in place and fully operational. The impact is of minor beneficial significance due to the slight reduction in maximum flood depths.

Impact of Project on fluvial flood risk during construction

5.3.5 The impact of the construction scenario on fluvial flood risk in the Haven is minor. The narrowing of the Haven at the barrier location causes less than 0.1m increase in the water level upstream during fluvial events.

5.3.6 This increase in water level does not cause fluvial flooding in Boston for any of the modelled flood events as they remain within the Haven. The impact of this small increase in water level in the upper Haven has been assessed to be of minor adverse significance.

5.4 Operation

Assessment assumptions and limitations

5.4.1 The following assumptions have been made for the operation of the Project:

- Barrier would be operated during tidal flood events only and for monthly, yearly and 5-yearly maintenance to test the functioning of the barrier. Raising during flood conditions may be for a longer time period, typically around eight hours. Other than these times normal tidal activity would continue in The Haven. The trigger level for the barrier is 5.3m AOD and this equates to around a 10% likelihood that the barrier would be raised in any given year (for the current climate); and

- There would be no impacts to traffic movements, noise or air quality during the operation of the barrier.

5.4.2 The main activities during the operation of the barrier that may cause potential impacts are:

- Closing of the barrier during a flood event;
- Closing of the barrier for maintenance; and
- The significance of any impact from the above activities is considered in the next section.

5.5 Operational impact assessment

5.5.1 Based on the current project plans it is not anticipated that any significant effects would occur as a result of barrier operation. This includes the process of raising/lowering the barrier as well as maintenance required to ensure its continued operation. The barrier's primary purpose is to reduce flood risk. Therefore, there would be beneficial effects on water levels.

5.5.2 As part of the operational assessment, it is assumed that best practice would be followed for all routine maintenance activities. For any non-routine activities, or where significant works are required, then construction phase best practice should be considered.

5.5.3 Maintenance dredging requirements during the operation of the Project would be completed be the PoB under their licences; no additional capital dredging requirements are anticipated as a result of the Project.

5.5.4 The barrier has been designed to reduce the risk of tidal flooding. The water level that can be held back by the barrier is dependent upon the crest elevation of the Haven Banks downstream of the barrier and its associated flood walls. Future planned phases of work would seek to raise these defences to a minimum standard.

5.5.5 Flood risk modelling also considers the change in fluvial flood risk as a result of the barrier construction. This has determined that the barrier does not provide a significant constriction, with increases of ~0.1m for the 1% AEP flood event. Flood water would remain in-bank during this event.

5.5.6 Full consideration of the impacts of the barrier upon flood risk under different scenarios is presented in the standalone FRA (see ES (Volume 2c): Flood Risk Assessment).

5.5.7 The barrier would be raised during a tidal flood event and lowered afterwards. During this time it is expected that there may be effects on turbidity and salinity on the upstream side of the barrier, as exchange with the incoming tidal waters is reduced. These impacts are considered temporary, as the barrier would only need to be raised for relatively short periods of time (typically no more than eight hours), and on an infrequent basis (there is approximately a 10%

likelihood the barrier would be raised in any given year). For this reason, the magnitude of effects from raising the barrier is considered low.

5.5.8 The presence of the barrier has the potential to result in changes to the channel morphology, estuarine processes and geomorphology. Whilst the barrier would be used infrequently, its presence represents an additional constriction which would not otherwise be present. Therefore, the ES (Volume 2b): Estuarine and Geomorphology Processes Technical Report and the ES (Volume 1): Chapter 12 gives consideration to changes in depths, velocities and bed shear stress, all of which may have impacts upon channel morphology. A summary of impact during project operations is shown in Table 5.2.

Table 5.2: Summary of impacts during operation

Receptor/ Baseline Asset	Description of issue	Value/ Importance	Magnitude of Impact	Impact Significance	Significant under EIA Regulations
Witham Transitional, downstream of Grand Sluice to the Wash (inner)	Increase in turbidity due to changes in flows mobilising sediment (barrier lowered).	Medium	Minor negative	Minor adverse	No
Witham Transitional, downstream of Grand Sluice to the Wash (inner)	Deterioration in water quality as a result of sediment bound contaminants being mobilised into the water column.	Medium	Minor negative	Minor adverse	No
Witham Transitional, downstream of Grand Sluice to the Wash (inner)	Changes to water quality upstream of the barrier (barrier closed).	Medium	Minor negative	Minor adverse	No
Witham Transitional, downstream of Grand Sluice	Flood risk	Medium	Moderate positive	Moderate beneficial	No

Source: Mott MacDonald 2016

Flood Risk Assessment

Impact of Project on tidal flood risk during operation

5.5.9 On completion of barrier, the storm surge is excluded from the Haven upstream of the barrier thus significantly reducing flood risk from water overtopping the flood defences. The proposed flood walls between the barrier and Maud Foster keep the modelled tidal flood events within the Haven, reducing flood risk in the Dock area from still-water overtopping during these extreme events (see ES (Volume 2c): Flood Risk Assessment: Figure 2.4).

5.5.10 There is no substantial change in the water levels within the Haven downstream of the barrier once Phase 3 is complete in the modelled tidal flood events (see ES (Volume 2c): Flood Risk Assessment: Appendix D; Figure D.5). Therefore, the risk of overtopping during tidal flood events remains unchanged for Skirbeck and parts of the Riverside Industrial Estate in Boston until the final Phase of the BCS is completed to provide improvements over time to the Haven banks in response to future sea level rise.

Impact of Project on fluvial flood risk during operation

5.5.11 The impact of the operational scenario on fluvial flood risk in the Haven is minor. The narrowing of the Haven at the barrier location causes an increase in the water level upstream during fluvial events (see ES (Volume 2c): Flood Risk Assessment: Appendix D; Figure D.10). This increase in water level does not increase fluvial flood risk in Boston town for any of the events shown because the water levels remain below the minimum cill level of the demountable defences.

5.6 Mitigation

5.6.1 Following assessment of impacts there are no significant impacts on surface water bodies identified during the construction or operation of the Project. Therefore, there are no mitigation measures identified over and above the embedded mitigation within the scheme design and best practice measures.

Construction

5.6.2 No significant impacts during the construction phase are predicted. The use of a cofferdam to construct foundations and install erosion protection would reduce the risk of sediment pollution with the waterbody. Sediment sampling is proposed by the Environment Agency prior to construction. The primary purpose of this is for assessment of suitability of the dredged material to be used as capping at a nearby landfill sites. Should this disposal option prove infeasible, then sampling results would provide a basis to undertake risk assessment for other disposal options.

Operation

5.6.3 There is a low residual risk that changes to the scour regime may release contaminants into the water column during the operational phase. However, there is low confidence in this prediction and as such it is recommended that a review of routine water quality monitoring data is undertaken during the early years of the operational phase, to assess the extent of any potential changes.

Monitoring

5.6.4 It is recommended that water quality monitoring is undertaken prior to, during and post construction. Should this identify significant changes to turbidity levels or contaminants, additional measures would be identified to reduce any impacts (such as temporary cessation of dredging works to allow flushing of sediment as part of the tidal cycle). While this is not considered as mitigation, it is a prudent action to provide early identification of any difference between predicted and actual conditions. A significant change to turbidity level should be identified within the context of typical background turbidity levels, as assessed across the tidal cycle.

5.7 Cumulative and in-combination effects

Inter-project cumulative effects

5.7.1 The inter-project cumulative effects have been assessed based on the current information available and a number of assumptions for the Environment Agency schemes. Should the final designs be different from the assumptions made here, the relevant project/scheme would revise the potential cumulative effects, as necessary.

5.7.2 A number of Environmental Agency schemes have been identified which, when considered alongside the proposed barrier may result in cumulative effects. These projects are:

- Piling downstream on the left bank of Grand Sluice. This project is to install a piled toe revetment on an area subject to slippage;
- Maintaining the Standard of Protection. This involves filling in low spots along the embankment; and
- Haven Banks upgrading (expected to start 2018/2019 and be completed by 2020). This work involves raising the crest of low spots in the Haven embankments to around 6.85m.

5.7.3 A number of other projects (residential developments) are proposed however these have no relevance to this topic and so are excluded from this assessment.

5.7.4 This project has not identified any significant construction effects which would also occur with the piling proposed on the left bank of Grand Sluice and the Maintaining of the Standard of Protection.

5.7.5 Upgrading of the Haven defences would require work within the water environment, potentially at the same time as the construction of the barrier. Providing that such works follow best practice, there is unlikely to be any significant cumulative effect as the works required are relatively minor (i.e. defences are being upgraded, rather than being rebuilt) and should not require significant excavation within the water environment.

5.7.6 This assessment therefore concludes that there would be no significant cumulative effects when the Boston Barrier is considered alongside other proposed developments.

In-combination effects

5.7.7 No in-combination cumulative effects were identified for surface water.

5.8 Climate change

5.8.1 Climate change is only relevant during the operational phase (estimated to be approximately 100 years for the purposes of this assessment). The principal climate change considerations relate to the effectiveness of the barrier. Climate change may result in changes to long term average variables such as temperature and precipitation, as well as changes to extremes. Changes to long-term mean sea level and changes to storm surges may increase the frequency of barrier closure and/or reduce its effectiveness against the design event.

5.8.2 Climate change impacts are considered in more detail in the ES (Volume 2c): Flood Risk Assessment.

5.8.3 Taking account of embedded mitigation there are no climate variables (minor variations to long-term temperature and rainfall as well as variations to extremes) that are predicted to exacerbate operational impacts.

6 Summary

6.1.1 This chapter has assessed the impacts of the proposed Project on the surface water environment.

6.1.2 The surface water environment can be considered heavily modified, with the natural flow regime of water bodies controlled by a series of locks and sluices. The water quality can generally be considered as good, despite the presence of some contaminated sediments.

6.1.3 The Project has the potential to negatively impact the environment through construction activities. Impacts are most likely during the construction phase, where works would be required within the waterbody. No significant residual construction effects are predicted.

6.1.4 It is considered that with the adoption of best practice for working in the water environment, no specific mitigation is required for construction activities.

6.1.5 When operational, the barrier would be raised and lowered on an infrequent basis. Any changes that occur to the surface water environment would be temporary and typically reversible.

6.1.6 The modelling results of the FRA (see ES (Volume 2c): Flood Risk Assessment) indicate that, on completion of the barrier construction, the risk from tidal flooding would be significantly reduced. There is no substantial change in the water levels within the Haven downstream of the barrier once complete for the tidal flood events that were modelled.

6.1.7 The modelling results for fluvial flood risk predicted that the barrier would not significantly increase fluvial flood risk to Boston town and is predicted to extend the period of tide-locking on the Lower Witham and South Forty Foot Drain by an additional 30-40 minutes during fluvial events due to the small increase in water level upstream of the barrier. The model also predicts that the barrier would not significantly increase fluvial flood risk on the River Witham and South Forty Foot Drain fluvial flood event under existing conditions nor when considering climate change in the next 100 years.

6.1.8 The WFD compliance assessment concludes that the Project is compliant with the Water Framework Directive.

6.1.9 Due to the nature of the operational activities, it is anticipated no significant residual operational effects would occur during the life of the Project.

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8 Abbreviations

Abbreviations	Definition
BOD	Biochemical Oxygen Demand
GEP	Good Ecological Potential
GES	Good Ecological Status
HMWB	Heavily Modified Water Body
PPG	Pollution Prevention Guidance
RBMP	River Basin Management Plan
SFFD	South Forty Foot Drain
WFD	Water Framework Directive

9 Glossary

Term	Definition
Baseline	A description of the present state of the environment with the consideration of how the environment would change in the future in the absence of the plan/programme/project as a result of natural events and other human activities.
Baseline studies/ survey	Collection of information about the environment which is likely to be affected by the project.
Catchment	A surface water catchment is the total area that drains into a river. A groundwater catchment is the total area that supplies the groundwater part of the river flow.
Conservation Area	An area designated under the Town and Country Planning Act, 1990 to protect its architectural or historic character.
Countryside and Rights of Way (CRoW) Act 2000	This Act applies to England and Wales and has five parts: - Access to the countryside Public rights of way and road traffic Nature conservation and wildlife protection Areas of outstanding natural beauty Miscellaneous and Supplementary This act increases the protection of SSSIs. Environment Agency plans/programmes/projects must gain consent for works in or near SSSIs using a CRoW form.
Cumulative Impacts	The combined impacts of several projects within an area, which individually are not significant, but together amount to a significant impact.
Department for Environment, Food and Rural Affairs (DEFRA)	The government department responsible for flood management policy in England.
Environmental Action Plan (EAP)	A standalone report or section within another environmental impact assessment document which ensures that constraints, objectives and targets set in the main Environmental Report/Statement are actually carried out on the ground. Actions are separated into those to be carried out before, during and after construction.
Environmental Impact Assessment (EIA)	"EIA is an assessment process applied to both new development proposals and changes or extensions to existing developments that are likely to have significant effects on the environment. The EIA process ensures that potential effects on the environment are considered, including natural resources such as water, air and soil; conservation of species and habitats; and community issues such as visual effects and impacts on the population. EIA provides a mechanism by which the interaction of environmental effects resulting from development can be predicted, allowing them to be avoided or reduced through the development of mitigation measures. As such, it is a critical part of the decision-making process." www.iema.net/eiareport
Environmentally Sensitive Area (ESA)	An area of particularly high landscape, wildlife or historical importance within which DEFRA offered inducements to encourage farmers to adopt agricultural practices to safeguard or enhance those features. Payments have now been superseded by the ESS.
Environmental Statement (ES)	The document produced to describe the environmental impact assessment process where statutory environmental impact assessment is required.
Flood risk mapping	A system of maps created by the Environment Agency to show areas that are at risk of a flood that has a 1 in 100 chance (or higher) of occurring in any given year.

Term	Definition
Health impact assessment	"A combination of procedures, methods and tools by which a policy, programme or project may be judged as its potential effects on the health of a population, and the distribution of those effects within a population." World Health Organisation.
Main river	A watercourse designated by DEFRA. The Environment Agency has permissive powers to carry out flood defence works, maintenance and operational activities on main rivers. Responsibility for maintenance rests on the riparian owner.
Marine Management Organisation	An executive non-departmental public body established under the Marine and Coastal Access Act 2009 with responsibilities including marine licensing and working with Natural England and others to manage a network of marine protected areas (marine conservation zones and European marine sites).
Mitigation measures	Actions that are taken to minimise, prevent or compensate for adverse effects of the development.
National Nature Reserve (NNR)	Nature reserves designated under the National Parks and Countryside Act (1949) for nationally important wildlife or geological features (these may be the best examples in the country). They are controlled by English Nature.
National Rivers Authority (NRA)	A predecessor of the Environment Agency.
Natural Areas	Sub-divisions of England, characterised by wildlife and natural features. There are 120 Natural Areas in England. Designations are managed by English Nature.
Natural England	Natural England is an Executive Non-departmental Public Body responsible to the Secretary of State for Environment, Food and Rural Affairs. Their purpose is to protect and improve England's natural environment and encourage people to enjoy and get involved in their surroundings. Their aim is to create a better natural environment that covers all of our urban, country and coastal landscapes, along with all of the animals, plants and other organisms that live with us.
Ordinary water course	A watercourse not designated as main river. The local authority or Internal Drainage Board has permissive powers to maintain them.
Ramsar site	Wetland site of international importance listed under the Convention on Wetlands of International Importance under the Conservation of Waterfowl Habitat (Ramsar) Convention 1973.
Scoping	The process of deciding the scope or level of detail of an EIA/ SEA. During this stage the key environmental issues (likely significant effects) of a project/strategy are identified so that the rest of the process can focus on these issues. Issues may result from the proposal itself or from sensitivities of the site.
Screening	(1) For environmental impact assessment, the process of deciding which developments require an environmental impact assessment to be carried out and whether this will be statutory. (2) For strategic environmental assessment, the decision on which plans, strategies or programmes require strategic environmental assessment to be carried out and whether this will be statutory.
Screening opinion	Statutory opinion from the competent authority as to whether a proposed project requires statutory environmental impact assessment according to the Environmental Impact Assessment Regulations.
Site of Special Scientific Interest (SSSI)	Nationally important sites designated for their flora, fauna, geological or physiographical features under the Wildlife and Countryside Act (1981) (as amended) and the Countryside Rights of Way (CRoW) Act (2000).

Term	Definition
Special Area for Conservation (SAC)	Sites of European importance for habitats and non-bird species. Above mean low water mark they are also SSSIs.
Special Protection Area (SPA) and proposed Special Protection Area (pSPA)	An area designated for rare or vulnerable birds, or migratory birds and their habitats, classified under Article 4 of the EC Directive on the Conservation of Wild Birds (79/409/EEC). They are also SSSIs. Proposed sites receive the same protection as fully protected sites.
Standard of protection (SoP)	The level of protection from flooding, for example an SoP of 1 in 100 means that the flood defences in an area provide protection from floods up to a size of flood with a probability of occurring of 1 in 100 in any year.
Strategic Environmental Assessment	SEA is a process designed to ensure that significant environmental effects arising from proposed plans and programmes are identified, assessed, subjected to public participation, taken into account by decision-makers, and monitored. SEA sets the framework for future assessment of development projects, some of which require Environmental Impact Assessment (EIA). SEA is carried out according to the requirements of the SEA Directive 2001/42/EC.

Appendices

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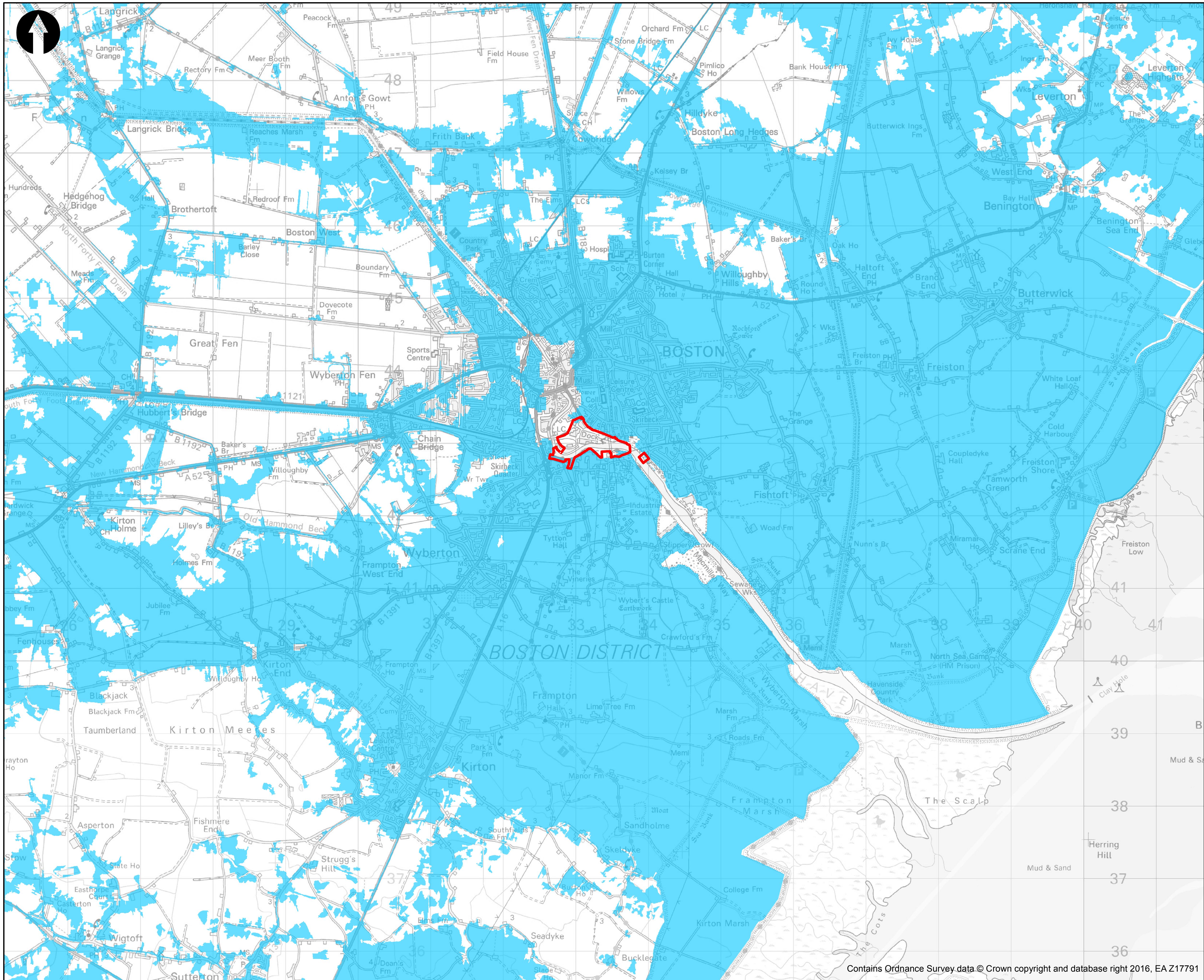
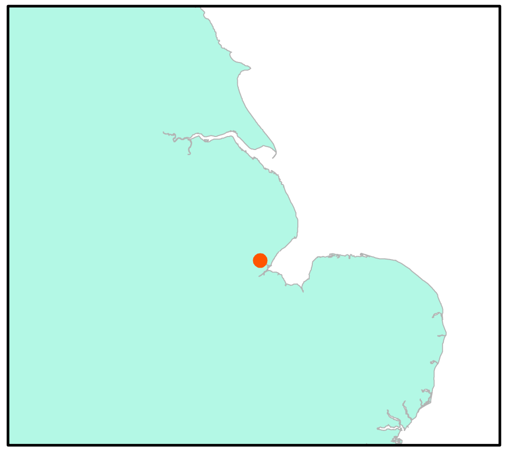
A. Figures



Key to Symbols

- Site boundary
- Flood Zone 3 (Tidal Extent)

Location Reference



Rev	Date	Drawn	Description	Ch'k'd	App'd
P1	21/07/16	DT	Updated site boundary	JL	EL
P0	16/07/15	LC	Draft	JL	EL

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Environment Agency

Title

Boston Barrier Project
Tidal Extent

Figure 2.1

Designed	J. Ledingham	ENV Check	L. Herbert
Drawn	L. Cutting	Coordination	G. Hughes
GIS Check	J. Ledingham	Approved	E. Lunt

Scale at A3	Status	Rev
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Figure Number
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B. Preliminary Water Framework Directive Compliance Assessment

Boston Barrier Tidal Project

Preliminary Water Framework Directive Compliance Assessment

August 2016

Environment Agency

Boston Barrier Tidal Project

Preliminary Water Framework Directive Compliance Assessment

August 2016

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Contents

1 Introduction

1.1 The Project

1.1.1 This Report forms a Technical Appendix of the Environmental Statement (ES) (Volume 2b): Surface Water and Flood Risk Technical Report that supports the Boston Barrier Project ES (Volume 1). Volume 1 documents the outputs of the Environmental Impact Assessment (EIA) for the Project. It identifies the predicted environmental impacts of the Project and recommends measures to mitigate significant adverse effects.

1.2 Overview

1.2.1 The purpose of the Project is to improve the standard of protection from tidal flooding. The proposals would not affect the existing standards of fluvial flood protection provided upstream within the River Witham and South Forty Foot Drain (SFFD). In January 2015 water level management (WLM) was removed from the scope of this current Project. In making the decision, the Environment Agency, Lincolnshire County Council (LCC) and Boston Borough Council (BBC) confirmed that it remains the vision to provide WLM at a later date through a standalone project and consenting process.

1.2.2 The Project would connect to the existing defences downstream of the town. The Project would consist of water-based works (the barrier structure) and land-based work (along the Haven).

1.2.3 Defences immediately downstream of the barrier structure would be improved to a 1 in 300 standard of protection as a part of the barrier structure works. This level of protection is to ensure protection against a 0.33% (1 in 300) annual probability of flooding over the 100 year project life.

1.2.4 The Project would be constructed south of the town of Boston across the area of the River Witham known as ‘the Haven’ (see ES (Volume 1): Appendix A; Figure 1.1). It would be approximately 100m downstream of Black Sluice, adjacent to the Starch Berth (on the Port of Boston (PoB) estate - left bank) and existing residential properties (along Wyberton Low Road - right bank).

1.2.5 It should be noted that, references to left and right bank of the Haven are described in a downstream facing direction. Therefore, the left bank (north side) is on the left side when facing downstream and the right bank (south side) is on the right side when facing downstream.

1.2.6 A detailed description of the Project is included in the ES (Volume 1): Chapter 2.

1.3 Purpose of assessment

1.3.1 The purpose of this preliminary Water Framework Directive (WFD) compliance assessment is to consider the WFD baseline relevant to the Project and the potential significant issues scoped in as part of the Project's Updated Scoping Report (Environment Agency, 2014).

1.3.2 A previous detailed WFD compliance assessment was prepared in 2012 (Boston Barrier Order, Water Framework Directive Detailed Compliance Assessment, IMAN001472, October 2012). This was based on an earlier barrier design that included options for water level management (WLM) alongside flood risk management. As the design and operational plan for the barrier no longer includes WLM, the potential impacts associated with the barrier have significantly reduced. Therefore, a new preliminary WFD compliance assessment has now been prepared to identify if a detailed WFD compliance assessment is required for the revised Project scope.

1.3.3 In order to produce a concise document, and to ensure consistency across the assessment, this assessment makes frequent reference to several Technical Reports within Volume 2 of this ES, which provide more detailed background information on some of the quality elements.

1.4 Water Framework Directive

1.4.1 The WFD was adopted by the European Commission in December 2000. It established a common framework across member states for the management of the water environment. The WFD is implemented in England and Wales by The Water Environment (Water Framework Directive) (England and Wales) Regulations SI 3242/2003. The objectives of the WFD are to:

- Prevent deterioration in the status of aquatic ecosystems, protect them and improve the ecological and chemical condition of waters;
- Aim to achieve at least good status for all waters by 2015. Where this is not possible, good status should be achieved by 2021 or 2027, where an extended deadline has been fully justified under Article 4.4 of the WFD;
- Promote the sustainable use of water;
- Conserve habitats and species that depend directly on water;
- Progressively reduce or phase out the release of individual pollutants or groups of pollutants that present a significant threat to the aquatic environment;
- Progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants; and
- Help reduce the effects of floods and droughts.

1.5 Responsibilities

1.5.1 The Environment Agency, which is responsible for implementing the WFD in England, has classified surface waters and groundwater into management units called 'water bodies'.

These water bodies form sub-units of the River Basin Management Plans (RBMPs). The status of each RBMP is reported to the EU to assess compliance with the WFD.

1.6 River Basin Management Plans

1.6.1 In total, there are three six-year RBMP planning cycles beginning in 2009 (that is 2009-2015, 2016-2021 and 2022-2027). The environmental objectives for each of the water bodies are given in the RBMPs. The first plan included a list of mitigation measures for artificial or heavily modified water bodies (HMWBs). The mitigation measures were listed as either ‘in place’ or ‘not in place’; implementation of these measures will facilitate achievement of good potential. The second round of RBMP plans provide more of a summary of measures, with more detail in the data that underpins the plans.

1.7 Water bodies

1.7.1 The term water body is used to encompass:

- Surface freshwaters (including lakes, streams and rivers);
- Groundwater;
- Estuaries; and
- Coastal waters (out to one mile from the baseline from which territorial waters are drawn).

1.7.2 No groundwater water bodies are potentially affected by the Project. Therefore, groundwater is not considered further in this assessment.

1.8 Water body objectives

1.8.1 Each water body has its own environmental objective to reach either overall good status or good potential. Artificial or HMWB have an objective to meet ‘good potential’ rather than good status.

1.8.2 Three different objectives are identified for each water body. These are:

- Overall status objective;
- Ecological status objective; and
- Chemical status objective.

1.9 Water body classification

1.9.1 In addition to water body objectives, each water body has been ‘classified’. As for objectives, there is an overall, an ecological and a chemical classification. Each of these three classifications is made up by several ‘quality elements’. A quality element can be considered as a parameter representing a specific aspect of the water environment, such as fish, phosphate or dissolved oxygen.

1.9.2 The quality elements used for classification are dependent upon the type of water body being classified and each quality element may be scored using monitoring data or by professional judgement (where no monitoring data exists). The Environment Agency currently undertakes monitoring of the WFD quality elements and assigns each element an appropriate classification.

1.10 Environmental objectives

1.10.1 The Environment Agency is required to produce a Programme of Measures (POM) summarised in the RBMPs for water bodies that are failing to meet good status. For each River Basin District, the POMs are set to ensure that good status or potential of surface water and groundwater bodies is achieved and that deterioration in the status of waters is prevented.

1.10.2 Article 4 of the WFD sets out the environmental objectives for all surface and groundwater bodies which the POMs must meet in each EU Member State.

1.11 WFD requirements

1.11.1 The WFD requires that the effects of new flood risk management activities on the water environment are assessed. Where plans, strategies and projects alter the hydromorphology or other characteristics of a body of surface water or estuary in such a way as to affect its ecological quality, the WFD requires the works to be carried out in the most environmentally sensitive manner, within the constraints of technical feasibility and cost. The project should also seek to contribute to the delivery of the RBMP objectives.

1.11.2 The Project is within the Anglian River Basin District (Environment Agency, 2009). The Anglian RBMP identifies the status of each water body and sets out actions for the Environment Agency and other partnership organisations, with the aim of preventing deterioration and enhancing the current status of all water bodies.

1.12 Purpose of WFD Compliance Assessment

1.12.1 The aim of the WFD compliance assessment is to determine whether the Project meets the following four objectives:

1. The project shall not result in a deterioration of quality elements from one status class to the next at water body level on a non-temporary basis.
2. The project shall not prevent the water bodies from achieving good potential.
3. Consider the contribution that the project can make to implementing localised mitigation measures and measures at the River Basin District or catchment level.
4. The project shall not cause a deterioration of, or prevent the achievement of the waterbody objectives, in other water bodies.

1.12.2 The preliminary WFD compliance assessment will consider the effects of the Project on:

- Environmental objectives;
- Relevant POMs; and
- Potential for the Project to contribute to implementing the POM.

1.13 Report structure

1.13.1 The structure of this Report is as follows:

- Chapter 2: Assessment methodology – sets out the approach to carrying out the preliminary WFD Compliance Assessment.
- Chapter 3: Baseline conditions – presents the baseline of each water body relevant to the Project.
- Chapter 4: WFD screening – presents the findings of a screening exercise to determine whether more detailed compliance assessment studies are required.
- Chapter 5: Conclusion – the Project findings of the assessment are summarised.

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2 Assessment methodology

2.1 Baseline

2.1.1 The methodology carried out for this preliminary assessment follows on from the screening and scoping work which had previously been carried out (Boston Barrier Order, Water Framework Directive Detailed Compliance Assessment, IMAN001472, October 2012). In particular, this assessment follows a similar study scope for the assessment of chemical and hydromorphological impacts and makes use of baseline studies carried out for the 2012 assessment.

2.1.2 A high-level baseline has been set out for each identified quality element; highlighting its current classification and considering the pressures on the water body. For the water bodies which may be affected, the characteristics of these water bodies (including the hydromorphological designation, morphological pressures, reasons for current failure and pressures) have been identified.

2.2 Limitations

2.2.1 We have used professional judgement to assess the likely effects of the Project at a high level. The remaining uncertainties are stated within this Report and recommendations for further work have been included which will reduce these uncertainties prior to implementation of the Project.

2.2.2 The assessment aims to make use of the most recent, relevant WFD data by using both 2009 and 2015 classification data. At the time of writing, the 2015 classifications have not been formally published and so may be subject to revision. The assessment uses the 2009 RBMP data as a baseline, but makes reference to the 2015 data in cases where there is a significant difference between the two (for example where an element fails in the 2015 classification but is classed as ‘good’ or above in 2009).

2.3 Methodologies to establish baseline

2.3.1 Baseline classification for the relevant water bodies was determined with reference to the Environment Agency classifications in the RBMP. The RBMP (2009) was used to report current status as the 2015 classifications have not been finalised at the time of writing (but are available in draft form). The baseline is necessarily concise, with consideration of the WFD quality element classifications only, rather than the detailed information that form these elements. Where there is uncertainty in a particular elements classification, this is carried through into the risk assessment process.

2.3.2 The 2015 RBMP classification has been reviewed and any differences have been carried through into this assessment. Changes to individual WFD elements from the 2009 classification are noted in the ‘Baseline Conditions’ section. The classification of individual elements has not changed significantly. Some information on the Mitigation Measures element was lacking from the 2015 RBMP dataset. While this represents an information gap the findings of the WFD assessment are not sensitive to this element.

2.4 Assessment of WFD objectives

2.4.1 The Environment Agency has developed a standard approach to identify components of a project which may be at risk of impacting on WFD status and associated WFD objectives for the relevant water bodies.

2.4.2 The impacts of the Project have been considered for each quality element, followed by the need for additional studies and / or mitigation, if appropriate. This assessment adopts the Environment Agency's approach, supplementing it with more detailed assessment where necessary.

2.4.3 An appraisal of mitigation measures for AWB (Artificial Water Bodies), HMWB (Heavily Modified Water Bodies) and measures on a catchment/RBD level was carried out to assess whether the Project will affect their implementation and the extent to which the Project can contribute to meeting them. The conclusion of the WFD compliance assessment sets out whether the Project is compliant with the WFD. Compliance is determined on three objectives:

- Project shall not result in a deterioration of quality elements from one status class to the next at water body level on a non-temporary basis;
- Project shall not prevent the water bodies from achieving good status/potential; and
- Project shall not result in the deterioration of another water body nor prevent the implementation of its mitigation measures.

2.4.4 The third objective is that the Project contributes to the implementation of mitigation measures and measures at the River Basin District or catchment level.

3 Baseline conditions

3.1 Overview

3.1.1 There are four water bodies within the vicinity of the Project. These four water bodies are shown in Figure 5.1 (see ES (Volume 2b): Surface Water and Flood Risk Technical Report; Appendix A) and are discussed further below.

Witham Transitional (the Haven) (GB530503000100)

3.1.2 The Witham Transitional waterbody is also known as the Haven. It is the tidal part of the River Witham extending from the tidal limit at Grand Sluice to the Wash. The Lower Witham drains into Witham Transitional by gravity through the Grand Sluice during low points in the tidal cycle. There is a lock at Grand Sluice for the passage of recreational craft, although narrow boats are unable to use the lock as it is too short.

Lower Witham (GB105030062420)

3.1.3 The Lower Witham comprises the lower reaches of the River Witham from Stamp End Lock in Lincoln to Boston. It has a large storage area upstream of Lincoln (on the Upper Witham). Its water level is controlled by the Grand Sluice within Boston (where it meets the Haven) and Branston Sluice which is situated between Lincoln and Grand Sluice. Boat passage through Grand Sluice is dependent upon the state of the tides.

South Forty Foot Drain (GB105030056620)

3.1.4 The South Forty Foot Drain (SFFD) is a 33.5km long water course that is fed by pump from approximately 30 Internal Drainage Board (IDB) ditches. The SFFD drains into the Haven on the right bank at Black Sluice, upstream of the Project. The SFFD drains by gravity through Black Sluice during low points in the tidal cycle, and if necessary via pumping when the sluice is tide locked.

3.1.5 The presence of other locks and sluices represent existing barriers to fish movement on the Lower Witham and SFFD water bodies. The proposed barrier will be closed on a relatively infrequent basis (The barrier has a 10% chance of closure in any single year and will close on average once per month by 2115) and is therefore not a permanent barrier to movement of ecological receptors nor will it significantly alter normal water levels. Therefore, no significant effects are predicted on the Lower Witham and SFFD water bodies and they will not be considered further as part of this WFD assessment.

The Wash (Inner) (GB530503311300)

3.1.6 The Haven discharges into the Wash (inner) which is a transitional waterbody covering the innermost areas of the Wash. It is approximately 25km long and is designated as a heavily modified water body due to designations for flood defence, navigation and shellfish.

3.1.7 Given that the Project location is within the Witham Transitional water body it is considered likely to be directly affected by the Project. The Wash (inner) may potentially be affected as it has a hydrological connection to the Witham Transitional. The Witham Transitional and the Wash (inner) will be the only water bodies considered further as part of this preliminary WFD assessment.

3.1.8 There are no groundwater bodies which have the potential to be impacted by the Project.

3.2 Witham Transitional Classification

3.2.1 The Witham Transitional is a typical estuarine water body and has previously been modified for navigational and flood defence purposes (and as such is designated as a HMWB for WFD classification).

3.2.2 Table 3.1 outlines the 2009 RBMP classification. As a HMWB, The Witham Transitional is required to meet 'Good Potential', rather than 'Good Status'.

Table 3.1: RBMP (2009) Classifications for Witham Transitional

Element	Classification
Overall Potential	Moderate
Ecological Potential	Moderate (uncertain)
Dissolved Inorganic Nitrate (DIN)	Moderate (uncertain)
Dissolved Oxygen (DO)	High
Arsenic	High
Copper	High
Permethrin	High
Tidal Regime	Supports Good
Overall Hydro-morphological quality	Not high
Mitigation Measures Assessment	Good
Chemical Status	Fail (Uncertain) -Tributyltin

Source: EA (2009) Anglian Region RBMP

3.2.3 Dissolved inorganic nitrate and tributyltin are the elements that currently result in the Witham Transitional being below 'Good' potential. The 2015 classification data indicated that the hydrological regime did not support good potential. The 2015 Dissolved inorganic nitrate classification was classed as Moderate, Tributylin was not assessed. The most significant change is that the 2015 classification considered that the 'Mitigation measures' element was below good. It is not currently known which mitigation measures are not in place although the reason given for the classification is that it is disproportionately expensive to implement the required measures.

Contaminants

3.2.4 Tributyltin (TBT) is a compound historically used within antifouling paint on boats. It can result in imposex within certain marine/estuarine species. Imposex is most commonly found in sea snails (such as the dog whelk) and results in females developing male reproductive organs, with negative impacts upon fertility and overall reproductive capability of a population.

3.2.5 Dissolved inorganic nitrate (DIN) is typically as a result of nutrient discharge from sewage treatment works or diffuse pollution from agriculture.

3.2.6 For the Witham Transitional, DIN is noted as being ‘disproportionately expensive’ to resolve, whereas TBT is noted as being ‘technically infeasible’. Recent information has indicated that the 2014 classification is identical to that of 2009. There are no identified mechanisms whereby the Project would alter the DIN and TBT failures.

Existing mitigation measures

3.2.7 The Mitigation Measures Assessment (MMA) element is a measure of the extent to which specific measures have been implemented on HMWB’s, in order to mitigate the effects of existing modifications. The following mitigation measures are noted as being in place (in the 2009 RBMP):

- Alter timing of dredging/disposal;
- Reduce impact of dredging;
- Prepare a dredging/disposal strategy;
- Avoid the need to dredge (for example, minimise under-keel clearance; use fluid mud navigation; flow manipulation or training works);
- Preserve and where possible enhance ecological value of marginal aquatic habitat, banks and riparian zone; and
- Bank rehabilitation/reprofiling.

3.2.8 It is not currently known whether specific mitigation measures are the cause of the 2015 ‘below good’ classification.

3.3 The Wash (inner) classification

3.3.1 Table 3.2 below presents the 2009 RBMP classification for the Wash (inner).

Table 3.2: RBMP (2009) Classifications for The Wash (inner)

Element	Classification
Overall Potential	Moderate
Ecological Potential	Good
Dissolved Inorganic Nitrate (DIN)	Moderate
Dissolved Oxygen (DO)	High

Element	Classification
Mitigation Measures Assessment	Moderate
Chemical Status	Good

Source: EA (2009) Anglian Region RBMP

3.4 Conclusion

3.4.1 The Witham Transitional and the Wash (inner) have been identified as being of relevance to this preliminary WFD assessment. An assessment of the impacts on these waterbodies is discussed in the next section.

4 WFD assessment

4.1 Initial assessment

4.1.1 The Environment Agency’s guidance for screening developments for WFD compliance identifies a number of steps required to assess WFD interests. Overall, decision making is based on the following criteria:

- Whether the waterbody is currently a high status waterbody;
- Whether initial screening indicates project components have the potential to impact upon any of the elements forming the current water body classification (as well as overall status); and
- Whether the project may impact upon the wider environment or Natura 2000 sites.

4.1.2 If any of these steps results in a positive answer, further assessment is required to consider whether or not an adverse impact can be expected.

4.1.3 Further assessment considers the extent to which the presence of any Project components may impact upon the classification of WFD quality elements for the water body (in this case the Witham Transitional). Quality elements of relevance to this waterbody are summarised in the baseline chapter (see Section 4.2).

4.1.4 Where adverse impacts on WFD interests are predicted, mitigation is required. If mitigation is not feasible, or cannot reduce the impacts, then an assessment of whether the Project meets the criteria in Article 4.7 would be applied. If this Project meets the criteria, it can progress; otherwise, it is considered non-compliant under the WFD.

4.1.5 A separate assessment is required to consider impacts on Natura 2000 sites and impacts on the wider environment. Impacts on the wider environment are assessed in the ES. Impacts on Natura 2000 sites have been assessed as part of the Habitats Regulations Screening assessment (EA form HR01), which can be found in ES (Volume 2b): Ecology and Nature Conservation Technical Report; Appendix B.

4.1.6 The Witham Transitional is not a high status waterbody nor does it have high status morphology. Therefore, it requires screening for risk of WFD deterioration and impacts on Natura 2000 sites and the wider environment.

4.2 Screening for risk of WFD deterioration

4.2.1 Screening identifies if the proposed components of a project are low risk activities, or it can be reasonably demonstrated that such components will not have an effect on the WFD classification then no further assessment of WFD interests is required.

4.2.2 All Project components must be included in the screening process. If one component is identified as resulting in an impact to WFD interests, this is enough to trigger further assessment. With regard to bank modifications, the total length of bank modifications (from both banks, measured along the centre line of the channel) is the appropriate measure for screening.

4.2.3 In certain cases, project components may not require more detailed assessment. This may be because they do not affect WFD interests (for example, the control building) or because the works are considered low risk and unlikely to result in a deterioration of the water body. Where this is the case, it is noted in Table 4.1 as not applicable (N/A) with the reasoning behind this decision.

Table 4.1: Screening for assessment of WFD compliance

Project component	Relevant threshold	WFD quality elements which may be at risk	Length
Barrier structure	Presence of an impounding structure	Hydromorphology, mitigation measures. No impacts to fish or eels on the basis that the barrier remains open for the majority of the time, that it will be flush with the bed and that changes to velocities and depths are minimal. Dredging may impact on shellfish beds in the Wash and potentially raise levels of TBT in the Transitional Witham.	N/A
Scour protection (permanent)	>100m considered high risk	Hydromorphology	80m (left bank and right bank)
Wet dock flood gate and widening of the wet dock entrance by 2.7m.	N/A - similar structure already in place	None, on the basis that the permanent structure will be similar to the existing.	N/A
Temporary works, including sheet pile cofferdams	N/A - temporary works	None on the basis that temporary works are unlikely to result in significant long-term impacts.	N/A
Control building and kiosk	N/A - land structure	None on the basis that the control building is on land, set back from the banks and does not have any potential to affect WFD elements	N/A
Sheet piled flood walls on left bank	>100m considered for high risk	Hydromorphology	830m (left bank)
A steel sheet piled flood wall on the right bank	>100m considered high risk	Hydromorphology	540m
Hard and soft landscaping	>200m considered high risk	Hydromorphology	N/A

Project component	Relevant threshold	WFD quality elements which may be at risk	Length
(including lighting)	for riparian vegetation management		
Access roads on left and right bank	N/A - temporary works	None on the basis that temporary works are unlikely to result in significant long-term impacts.	N/A

4.2.4 Components which do not individually result in a predicted effect on WFD quality elements may still result in a cumulative effect. This assessment identifies that the access roads, control building and temporary works are not likely to impact WFD quality elements. There is no justification for cumulative effects occurring from these three components as they are distinct features whose individual effects are likely to be considerably different.

4.2.5 Following the initial screening, it is clear that there are number of Project components which require preliminary assessment. These components include the barrier, flood walls, scour protection and landscaping measures.

4.3 Preliminary assessment

Hydromorphology

4.3.1 The principal WFD component at risk from the Project is hydromorphology due to the extent of permanent Project components either within or immediately adjacent to the water environment. There is also potential for impacts to ecological elements if significant changes to hydromorphology are predicted. The permanent siting of Project components is not predicted to impact long-term on water chemistry.

4.3.2 Hydromorphology is principally at risk because of the presence of the barrier structure, which will constrict the channel. There is also the presence of a number of linear features on both the left and right banks (scour protection, sheet piling and hard/soft landscaping). It is not anticipated that dredging will affect the WFD status as the water body is already designated as heavily modified for navigation, the principal reason for dredging. While capital and maintenance dredging patterns may change during and post-construction of the barrier, there is no evidence to indicate an elevated risk of contaminant mobilisation (such as TBT).

4.3.3 For more detailed information on the baseline hydromorphological conditions, the reader is directed towards the hydromorphological walkover note (HJA, 2010) which describes the existing hydromorphological conditions, including the presence of existing artificial features. These have not changed significantly since 2010.

4.3.4 In summary, the hydromorphology of the Witham Transitional can be described by splitting the water body into two zones. Between Grand Sluice and the PoB entrance, the channel is continuously confined on both sides by heavy engineering such as sheet piling, walls and the swing bridge. Downstream of the entrance of the PoB, engineered features are still present. However, there are a number of features such as saltmarsh and mudflats which contribute to a semi-natural hydromorphological character.

4.3.5 The barrier structure is predicted to result in small changes to depths and velocities within its immediate vicinity (a maximum of 150m up/downstream under normal flow and tidal conditions). These are not considered to represent significant changes to hydrodynamic conditions, as absolute increases in velocity are minor, occur for a short duration over a small predicted extent). More detailed information on modelling results is contained in the ES (Volume 1): Chapter 12. Changes to estuarine habitats as a result of altered hydrodynamics are considered not significant, because there is no estuarine habitat permanently affected. However, the construction of the barrier and associated components will result in 0.3 ha of permanent habitat loss. More detail on changes to estuarine habitats is contained in the ES (Volume 1): Chapter 10.

4.3.6 The barrier structure will not result in long-term changes to water levels, as closure of the barrier gates would be prior to a tidal surge event and for testing. This represents a very short period (potentially 18 hours during an actual event) where water levels would be affected. The chance of barrier closure during an event is approximately 10% in any one year. In addition, the barrier structure would be tested once per month, at any level of the tidal cycle (that is, between low and high tide). As such, no long-term changes to water levels are predicted as a result of barrier operation and there are therefore no significant changes to estuarine morphology are likely as a result of the barrier operation.

4.3.7 Flood walls, sheet piling and scour protection represent linear features which have the potential to result in changes to hydromorphological conditions. However, existing morphology within the estuary is heavily modified, with a number of similar artificial features in this location.

4.3.8 Flood walls on the left bank will be located in areas where the bank has been artificially altered. Therefore, replacement or additions in these areas do not represent significant changes from the current hydromorphological conditions. Predicted changes in estuarine habitats during the operational phase are minimal. Changes in estuarine habitats during the construction phase are temporary and reversible as land take of mudflat during construction of flood walls which will naturally return to mudflat post-construction (see ES (Volume 1): Chapter 10).

4.3.9 The proposed flood walls on the right bank would represent a slight change to the current conditions. The right bank currently exhibits some natural estuarine features such as small areas of mudflat. However, there is also a significant amount of flood embankment. As the flood walls will be set back, they will not remove or reduce the extent of mudflat. As such, the key remaining morphological features will remain untouched. It is unlikely that the presence of the Project components will reduce habitat availability under the influences of climate change, as the existing mudflats and saltmarsh are already constrained by existing engineered features.

4.3.10 Overall, while the Project will result in some change to the hydromorphology of the water body it will not result in a change in WFD element classification.

Physico-chemical conditions and priority substances

4.3.11 The Project will not result in the discharge of chemical substances into the Witham Transitional. The principal risk to WFD water quality parameters (TBT, DO, DIN, temperature and transparency) is from remobilisation of sediment or chemical substances. Predicted changes during the operational phase of the barrier are minimal, as maintenance dredging requirements will not be increased. Therefore, the risk of increasing nutrient levels (through re-suspension of nutrients within sediment) would not be greater than currently occurs from ongoing dredging by the Port of Boston. There may be an increased risk during construction. However, this is not expected to result in long-term changes to water chemistry.

4.3.12 The exception to this is the potential for the release of TBT into the water column during dredging. The Witham Transitional has a current failure for TBT. While the WFD classification cannot get worse, remobilisation of TBT from within sediments may prevent recovery. However, this is considered unlikely as TBT in sediment is most likely to stay bound to that sediment. The operation of the barrier will not to prevent recovery of the Haven with respect to TBT, as TBT is likely to become less persistent through time. It is not known whether TBT levels in the area of the Project are significant. Therefore, while the risk is considered low, it is recommended that detailed method statements are produced to minimise the likelihood of TBT being introduced into the water column.

Biological elements

4.3.13 ES (Volume 2b): Ecology and Nature Conservation Technical Report provides more detail on the impacts that could be expected on fish, aquatic invertebrates and estuarine habitat. That assessment concludes that negligible changes to fish and aquatic invertebrates are expected. Small changes to sediment erosion and accretion may occur over a short distance downstream of the barrier structure. However, this is considered not significant due to the relatively short extent over which an impact is likely to occur.

4.3.14 The presence of the barrier is not expected to affect other relevant WFD biological indicator classifications for estuaries such as macro-algae and angiosperms.

4.3.15 Due to the existing channel constriction downstream of the barrier structure, the Project is unlikely to exacerbate coastal squeeze effects.

4.3.16 In summary, the form and extent of Project components have the potential to result in WFD element deterioration within the Witham Transitional water body. However, the existence of a large number of artificial features and the associated ‘not high’ classification for hydromorphology indicates that baseline conditions can be considered unnatural. Also, as the majority of components will be located in areas with existing artificial features such as the walls on the left bank downstream of the barrier structure, the overall hydromorphological character of the estuary is unlikely to be significantly altered. No significant effects are predicted on the status of biological or physicochemical elements.

4.4 Effects on Natura 2000 sites and impacts on the wider environment

4.4.1 The nearest Natura 2000 sites to the Project are the Wash and North Norfolk Coast SAC (designated for Annex 1 habitats, including sandbanks and coastal lagoons) and the Wash SPA and Ramsar site (designated for a number of Annex 1 bird species), both approximately 4.7km downstream (or 4.2km in a direct line) from the barrier structure. Assessment of the potential impacts of the Project on these designated sites has been undertaken by the Environment Agency and reported on in a Stage 2 Screening Assessment (EA Form HR01) in line with the requirements of the Conservation of Habitats and Species Regulations (2010). The outcome of this assessment, as agreed with Natural England, was that no significant effects were likely on the above mentioned designated sites.

4.4.2 There are no designated bathing sites which could reasonably be impacted by the Project.

4.4.3 The Project also has the potential to impact upon shellfish areas in the Wash (inner) through the resuspension of sediment and nutrients as a result of the capital dredging[1] required for the Project. Shellfish areas exist adjacent to the Witham Transitional water body, within the Wash. A review of modelling results and the extent of the dredging regime indicates that effects on shellfish areas are unlikely. Re-suspended material from dredging is unlikely to travel as far as the shellfish beds. Any increase in re-suspended sediment would be negligible in terms of the overall local sediment budget. The majority of sediment on incoming tides is derived from the Wash and resuspension is only possible over the dredged area which represents a small proportion of the overall water body and so it is not considered that there is any significant risk to shellfish beds.

4.4.4 Current plans for capital dredging are to reuse dredged material on land and as part of the Project and dispose at landfill as the last resort. The current level of maintenance dredging carried out by the PoB through the Haven is not expected to change as a result of the Project.

4.5 Ability to implement mitigation measures

4.5.1 As discussed in Section 3.2.7, the majority of RBMP waterbody mitigation measures noted as being in place for the Witham Transitional relate to dredging. These include: altering the

[1] Capital dredging can be considered as dredging carried out to increase depths in an area, usually, but not always, for the first time. Maintenance dredging can be considered as dredging that occurs on a reasonably regular basis, to maintain depths.

timing of dredging/disposal; reducing the impact of dredging; preparing a dredging strategy; and avoiding the need to dredge.

4.5.2 The Project has the potential to help assist the implementation of RBMP waterbody mitigation measures by:

- Considering when capital dredging is carried out as part of construction programme (through development of the barrier dredging plans and method statements);
- Managing the disposal of dredged material in a sensitive manner (by identifying the most sustainable disposal option as part of the barrier dredging plans); and
- Complementing the existing dredging strategy (through aligning barrier dredging plans with the existing PoB dredging strategy).

4.5.3 As far as possible, the barrier has been designed to minimise the overall need for dredging through consideration of the footprint and the choice of construction method. However, given the nature of the Project there is still a requirement for some level of capital dredging.

4.5.4 The impact of dredging has been reduced by undertaking such works at times of year to minimise the risk of adverse impacts to fish and by only dredging selected areas to facilitate construction works.

4.5.5 Capital dredging has been scheduled around known environmental constraints; dredging is anticipated to occur between mid-October and mid-March and during low tide to avoid changes to water quality namely a decrease in dissolved oxygen.

4.5.6 Dredging will avoid smelt spawning periods and will not be carried out throughout the warmer months to reduce the risk of algal blooms resulting from nutrient mobilisation. There will be no change in the volume of freshwater delivered to The Wash.

4.5.7 It is anticipated that the maintenance dredging regime (timing and volume) would be similar to current practice. Maintenance dredging will continue to be carried out by PoB.

4.5.8 The installation of hard engineered features has the potential to reduce the likelihood of implementing these mitigation measures. However, where practical and feasible, Project design will incorporate measures relating to bank naturalisation. These include:

- Preserve and where possible enhance ecological value of marginal aquatic habitat, banks and riparian zone; and
- Bank rehabilitation/reprofiling.

4.5.9 The linear components of the Project are predominantly located in areas which have existing artificial features. Therefore, these features will not prevent the implementation of WFD mitigation measures for the waterbody.

4.5.10 The barrier structure will represent a new channel modification, representing a permanent constriction. However, it will not prevent the implementation of the identified WFD mitigation measures for the waterbody.

4.6 Next steps

4.6.1 This is a preliminary assessment of the likelihood of water quality elements being affected as a result of the Project. Based on the Project components, no significant effects would be anticipated on WFD quality elements at the water body level. Short-term impacts would be likely during construction; these are discussed in the ES (Volume 2b): Surface Water and Flood Risk Technical Report as well as ES (Volume 2b): Estuarine Processes and Geomorphology Technical Report and will be managed using best practice construction techniques. No permanent impacts are expected as a result of the construction phase activities. Construction related impacts would not affect WFD quality elements as changes are expected to be short-term and reversible.

4.6.2 Based on this preliminary assessment, no changes to the classification of any WFD elements are predicted.

5 Conclusion

5.1 Current WFD baseline

5.1.1 The Witham Transitional is classified as a HMWB. This is due to modifications made for navigation and flood defence. The water body is also subject to pressure from existing DIN and TBT pollution.

5.1.2 The current objectives for the Witham Transitional waterbody are for it to meet good Ecological and Chemical Potential by 2027. It is considered technically infeasible and disproportionately expensive by the Environment Agency to achieve these targets any earlier.

5.2 Project impacts on WFD quality elements

5.2.1 Several Project components such as the barrier structure and flood wall defences have the potential to impact upon WFD interests and as such a preliminary assessment of their impact has been undertaken. The principal risk from these components is a downgrade to morphology. However, the components in question are an integral part of managing flood risk, for which the Witham Transitional is already classified as heavily modified. In addition, the location of these components indicates they are unlikely to significantly alter the hydromorphological conditions of the water body. The reasons for this are because components are located in areas where there are existing morphological alterations. The introduction of these components is not likely to result in a change to the morphological features of interest such as mudflats. As such, it is likely that these additional alterations are unlikely to result in a change of status nor prevent the Witham Transitional from meeting GEP.

5.2.2 Consideration of other relevant WFD quality elements (biological and physico-chemical) has indicated that the Project is unlikely to result in changes to the classification of these elements. The primary reasons for this include:

- The Project proposes no changes to the current maintenance dredging requirements;
- The Project would not result in changes to discharges (combined sewage overflows, treated wastewater and drainage) into the Haven;
- The Project would not significantly alter the hydraulic conditions permanently within the Haven (albeit there will be some small changes around the barrier structure itself); and
- The linear components of the Project are in areas which already exhibit engineered features.

5.2.3 As such, no requirement for a more detailed WFD assessment has been identified.

5.3 Opportunities to realise WFD benefits

5.3.1 During detailed design, consideration will be given to identifying potential design alterations to help implement the POM. In particular, the following mitigation measures should be considered as part of detailed design:

- Preserve and where possible enhance ecological value of marginal aquatic habitat, banks and riparian zone; and
- Bank rehabilitation/reprofiling.

6 References

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7 Abbreviations

Acronym	Description
AWB	Artificial Water Body
BBC	Boston Borough Council
DIN	Dissolved Inorganic Nitrate
EIA	Environmental Impact Assessment
ES	Environmental Statement
HMWB	Heavily Modified Water Body
MMA	Mitigation Measures Assessment
POM	Programme of Measures
PoB	Port of Boston
RBMP	River Basin Management Plan
SFFD	South Forty Foot Drain
TBT	Tributylin
WFD	Water Framework Directive

8 Glossary

Term	Definition
Hydromorphology:	The study of the influence of water on landforms. In particular how water influences channel formation and alteration in riverine, estuarine and coastal systems.
Imposex:	A disorder primarily restricted to sea snails. The presence of toxic chemicals in the marine environment results in female snails developing male sex organs.
River Basin Management Plan:	Plans which provide a summary of measures for water bodies in a particular river basin which are classified under the WFD. Plans are revised on a six year cycle.
Transitional water body:	A water body which is neither wholly coastal nor fluvial, but typically links the two. Estuaries are the most common transitional water body.
Tributylin:	A chemical substance which was historically used within antifouling paint applied to boats. Now banned, it is responsible for Imposex in sea snails (see above).

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C. Sediment Chemistry Report

Boston Barrier and Haven Works

Water Quality and Sediment Chemistry Technical Note

V. Guerra

March 2011

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Halcrow

Document Control Sheet

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CONTENTS

1 Introduction

1.1 Overview

Halcrow Jacobs Alliance has been commissioned to undertake a water quality survey programme on a 3.5 km stretch of the River Witham, downstream of the town centre of Boston, Lincolnshire. This technical note details the findings of the surveys undertaken between April 2010 and January 2011.

1.2 Background to proposed development

The town of Boston has historically been subject to flooding, particularly from the sea. Existing flood structures currently protect the town from flooding to a level of 6.0 m AOD. The river channel is engineered through most of the town down to the South Forty Foot Drain.

The Boston Combined Strategy comprises of a number of phases of work to reduce the risk to people and the environment from flooding and provide a safe and attractive navigation link to the proposed Fens Waterways Link.

Two projects arising from the Strategy are the Boston Barrier and Haven Works:

- The Haven Works will comprise improvement works to flood assets at risk of failure; and
- The Boston Barrier will be a multi-functional barrier to provide improved protection against tidal flooding, whilst also providing waterways benefits.

Halcrow Jacobs Alliance (HJA) has been commissioned by the Environment Agency (EA) to prepare a Project Appraisal Report (PAR) for each of the projects.

1.3 Study Area

The River Witham flows through Boston with Grand Sluice defining the tidal limit of and entrance to 'The Haven'. The river flows in a generally south eastward direction, receiving flows from the South Forty Foot Drain, Maud Foster and Hobhole Drains, until it eventually discharges into The Wash.

1.4 Survey Aims

This technical note presents the findings of the water quality and sediment survey carried out in the Witham Estuary by Jacobs between spring 2010 and winter 2011. A further water quality (WQ) survey, including long-term instrumentation deployments, was carried out by Halcrow during spring 2010 and is reported separately. The key reason for providing this summary report is to identify whether the samples include any specific pollutant or source of contamination which may influence the location of the proposed barrier and impact of other related works.

2 Methods

2.1 Water Sampling Methodology

Jacobs undertook a water quality survey on board of the vessel 'Water Guardian' on the 20th April 2010. Samples were collected at eight different locations (see Table 1 and Appendix A) to characterise the water quality within the estuary and to supplement existing data. The vessel held position at each site and the location was recorded with a handheld global positioning system (GPS) unit. Water samples were collected from 0.5 m below the surface for chemical analysis.

All samples were labelled and stored appropriately before being sent for analysis at the EA laboratory (UKAS accredited) National Laboratory Service (NLS).

Table 1: Water Quality sampling locations and time of sampling.

Site	Locations	Time
Site 1	N52° 58.307' W0° 01.421'	08:24
Site 2	N52° 58.114' W0° 01.553'	08:53
Site 3	N52° 58.052' W0° 01.050'	09:08
Site 4	N52° 57.959' W0° 00.475'	09:26
Site 5	N52° 57.122' E0° 00.561'	09:44
Site 6	N52° 56.277' E0° 01.812'	10:01
Site 7	N52° 55.813' E0° 03.748'	10:18
Site 8	N52° 55.975' E0° 04.740'	10:31

Additionally, physico-chemical parameters were measured during each subtidal fisheries survey (April 2010, July 2010, October 2010 and January 2011) using a multiparameter sonde. The instrument (Idronaut 305/89) recorded temperature, salinity, pH, dissolved oxygen and water depth continuously with a 0.5 second interval. Results are reported in Section 3.1.

2.2 Sediment Sampling Methodology

The estuary is comprised of appreciable intertidal areas in addition to the central channel which is permanently submerged, with both intertidal and subtidal habitats characterised by soft mud. As the level of emersion/immersion and the longitudinal salinity gradient will be the primary natural factors driving the benthic community patterns, both intertidal and subtidal areas were sampled. Samples were collected at three locations in the estuary (see Table 2 and Appendix A) to characterise the sediment chemistry within the estuary and to supplement existing data.

The survey was completed on the survey vessel 'Water Guardian' on the 29th April 2010. Samples were collected for physicochemical analysis using a 0.05 m^2 Van Veen grab at each intertidal and subtidal site. Three additional replicate samples were also collected for faunal analysis (Lee Elliott. 2010).

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All collected samples, after being labelled and stored appropriately, were returned to the EA laboratory (UKAS accredited) National Laboratory Service (NLS) for subsequent analysis.

Table 2: Sediment sampling locations and time of sampling.

Site Name	Approximate Location	Time of grabs
Corporation Point	N52° 57.162' E0° 00.490'	07:35 – 07:57
Hobhole Drain	N52° 56.170' E0° 02.081'	08:15 – 08:32
Upstream of the Docks	N52° 58.059' W0° 00.878'	09:14 – 09:37

2.3 Laboratory Analysis

All water samples collected on the 20th of April 2010 were analysed for total nutrients, total metals (including Mercury, Copper and Iron) and a range of contaminants (including some Polycyclic Aromatic Hydrocarbons, Organotins, Volatile and Semi-Volatile Organic Compounds and Phenols). All data is presented in Appendix B.

All sediment samples were sent to the National Laboratory Service unpreserved in a 1 litre plastic pot. Each sample appeared to be dark grey very wet sticky soft sediment. Sediment samples were analysed for a range of contaminants (including heavy metals, some Polycyclic Aromatic Hydrocarbons, Organotins, Pesticides, Volatile Organic Compounds and Phenols) using appropriate analytical techniques.

A portion of each sample was taken for drying at <30 °C. Each sample was sieved to <10mm before being crushed using a pestle and mortar. No waste was discarded after sieving at 10mm. All parameters were determined on the air-dried (<30 °C) portion except those requiring a wet sample fraction where as received (wet) sample was used.

Dry Weight (DW) results are reported as determined at <30 °C. All result from the sediment analysis have been broken down by chemical group and presented in Appendix C.

Granulometric analysis was also undertaken. All the raw data are presented in Appendix D.

2.4 Legislative Standards

Where applicable, water quality results have been compared to Marine Environmental Quality Standards (EQS). EQS values have been derived from the Dangerous Substances Directive (76/464/EEC; codified as 2006/11/EC) which classifies substances under List I and List II. List I substances are those deemed to be particularly dangerous to the environment owing to their toxicity, persistence and bioaccumulation. List II substances, while less dangerous, are still considered to have a deleterious effect on the aquatic environment. The metals reported here also include those cited as priority substances under the Water Framework Directive (Cd, Hg, Pb and Ni), the standards of which were revised in the EU Directive 2008/105/EC resulting in stricter limits being applied for these metals. This Directive lays down EQS's for 33 substances (including priority substances and other pollutants). The EQS's stated are those for 'annual average other surface waters'.

At present there are no statutory EQS's for marine and estuarine sediments in the UK. The current recommended procedure is to use the Threshold Effects Levels (TEL) and Probable Effect Levels (PEL) approach developed by Environment Canada (CCME, 1999) which assesses the likelihood of sediment contamination having a biological impact. The TEL and PEL were derived from an extensive database containing direct measurements of the toxicity of contaminated sediments to a range of aquatic organisms exposed in laboratory tests and under field conditions. The TEL of a substance is the concentration below which sediment associated chemicals are not considered to represent significant hazards to aquatic organisms while the PEL represents the lowest concentration of a substance that is known to have an adverse impact on aquatic organisms. Effects may be observed in some sensitive species exposed to the TEL, whereas the PEL is likely to cause adverse effects in a wider range of organisms. Interim Sediment Quality Guidelines (ISQG) based on the TEL values have been adopted in England and Wales by the Environment Agency and as the best practice approach for Habitats Directive Review of Consents in estuaries in the UK (CCME, 1999; UK MSAC Project, 2007). In general, where sediment concentrations of toxic substances are close to exceeding the TEL, conservation agency staff should identify sediment concentrations as a cause for concern and seek to minimise further inputs of these substances to the European marine site (UK MSAC Project, 2007).

3 Results and Discussion

3.1 Physico-chemical parameters

All continuous recording data collected during the July, October 2010 and January 2011 surveys are summarised below. Continuous recording data from April 2010 are not available due to a technical problem with the sonde. Temperature and salinity data were, however, recorded discretely at each sampling location during the water quality survey in April and have been used to supplement the continuous data in this report. Dissolved Oxygen and pH data are not available.

3.1.1 Temperature

Temperature values recorded during April 2010 survey ranged between 9.64˚C and 11.43˚C. During July 2010 survey, values ranged between 19.60˚C and 18.03˚C. During October 2010 survey, values raged between 8.89˚C and 7.77˚C. In January 2011, temperature values ranged between 5.17˚C and 4.54˚C.

A summary of the maximum and minimum values can be found in Table 3.

Table 3: Temperature vales.

Date	Temperature (˚C)	
	Max.	Min.
20/04/2010	11.43	9.64
29/07/2010	19.60	18.03
26/10/2010	8.89	7.77
26/01/2011	5.17	4.54

3.1.2 Salinity

Salinity values recorded during October 2010 survey and January 2011 survey show an important influence of freshwater at the surface. It is suspected that the low salinity values identified in bold in Table 4 are the result of rainwater and/or increased influence of freshwater from local sluice operation.

A summary of maximum and minimum salinity vales can be found in Table 4.

Table 4: Salinity values (Figures in bold indicate those samples showing a high freshwater influence).

Date	Salinity	
	Max.	Min.
20/04/2010	31.11	**3.38**
29/07/2010	33.34	16.55
26/10/2010	25.98	**4.50**
26/01/2011	**8.98**	**0.81**

3.1.3 Dissolved Oxygen

All data collected during the surveys are within the expected range of estuarine waters. The maximum value was recorded in January 2011 (97.10%) and the minimum value in July 2010 (62%). The mean value for the latter survey was 85.04%. Table 5 summarises the maximum and minimum values recorded for each survey.

Table 5: Dissolved Oxygen (DO) values.

Date	DO (%)	
	Max.	Min.
29/04/2010	n/a	n/a
29/07/2010	91.40	62.00
26/10/2010	90.20	81.20
26/01/2011	97.10	87.20

3.1.4 pH

pH data recorded are within the expected values for estuarine water. Table 6 summarises the maximum and minimum values recorded during each survey.

Table 6: pH values.

Date	pH	
	Max.	Min.
29/04/2010	n/a	n/a
29/07/2010	8.21	7.84
26/10/2010	8.24	7.94
26/01/2011	8.09	7.93

3.2 Water Quality Laboratory Results

Many of the concentrations recorded fell below the minimum reporting value (MRV) or Limits of Detection (LoD) set by the analysing laboratory. The MRV is a minimum concentration selected for reporting purposes which is often higher than the statistically derived method limit of detection (the concentration of a substance at which there is a desirably small probability that it will not be detected). The MRV is used to provide consistency of reporting as well as an allowance for sample variation. The LoD and MRV are values given and are based upon ideal analysis conditions, though some factors such as matrix contamination or insufficient volume may cause a raise in LoD due to the need for dilution. Water quality results have been divided into groups for ease of reading and can be found in Appendix B. All raw data are presented in Appendix D.

3.2.1 Oxygen Demand (BOD and COD)

BOD was determined using a 5-day test and values for half of the sites (sites 2, 3, 4 and 7) were below the MRV of 2.90 mgl^{-1}. Sites 5 and 6 registered the maximum value of 3.50 mgl^{-1}.

COD data are only available for sites 1 to 4. All data were reported as being below the MRV (300 mgl^{-1}).

All data are presented in Table B 1 (Appendix B). Results for oxygen demand fell within the expected range for estuarine samples and are of no cause for concern.

3.2.2 Chlorophyll

Chlorophyll was analysed using a spectrophotometer following acetone extraction. Values reported range between 11.9 μgl^{-1} (site 4) and 22.8 μgl^{-1} (site 6), with a mean value of 17.1 μgl^{-1}. All data can be found in Table B 1 (Appendix B).

3.2.3 Nutrients

Nutrient concentrations were determined for all samples taken. All data are presented in Table B 1 (Appendix B).

Ammoniacal nitrogen (as N) ranged between 0.015 mgl^{-1} (site 8) and 0.156 mgl^{-1} (site 3).

Results showed total oxidised nitrogen (consisting of nitrite and nitrate) ranging between 0.58 mgl^{-1} (site 8) and 7.65 mgl^{-1} (site 1). Nitrate concentrations ranged between 0.0097 mgl^{-1} (site 8) and 0.0518 mgl^{-1} (site 4). Orthophosphate concentrations ranged between values below the MRV of 0.02 mgl^{-1} (sites 7 and 8) and 0.076 mgl^{-1} (site 4). Silicate concentrations ranged between values below the MRV of 0.20 mgl^{-1} (sites 6, 7 and 8) and 0.59 mgl^{-1} (site 4). Highest concentrations of phosphate, nitrogen and silicate compounds were found at sites 4, 3 and 2 respectively.

All nutrient concentrations were relatively low and did not indicate nutrient enrichment.

3.2.4 Metals

Heavy metals are found throughout the marine environment as a result of both natural background levels and anthropogenic input.

Results for sampled metals are presented in Table B 2 (Appendix B) and have been compared to relevant EQS.

All metals sampled in April 2010 were found to be below the relevant EQS with the exception of Iron[1] at site 2, where it was recorded at 1130 μgl^{-1}. Some metals, such as Cadmium, Vanadium and Mercury, were found below the MRV.

[1] The EQS related to Iron is a non-statutory UK guidance driven by the Council Directive on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community (dangerous Substances Directive) – List II substances (76/464/EEC) and The Department of the Environment Circular 7/89.

3.2.5 Hydrocarbons

Polycyclic Aromatic Hydrocarbons (PAHs), Organotins (O-tins), Volatile and Semi-Volatile Organic Compounds (VOCs and SVOCs) were determined by solvent extraction followed by gas chromatography - mass spectroscopy (GC-MS). All data are presented in Table B 3, Table B 4 and Table B 5 respectively (Appendix B). Phenols were determined by solvent extraction, derivitisation, followed by GC-MS and the data are presented in Table B 6 (Appendix B).

(a) Total Petroleum Hydrocarbons (TPH)

All results for Total Petroleum Hydrocarbons C5 to C44 were reported as below the MRV (0.20 mgl^{-1}).

(b) PAHs

All PAHs compounds analysed were found to be below the MRV with the exception of naphthalene where at sites 5 and 6 a concentration of 0.015 μgl^{-1} and 0.012 μgl^{-1} respectively was reported.

(c) Organotins

All Organotins compounds analysed were found below the MRV with the exception of Monobutyl Tin. At sites 1 and 2 a concentration of 0.003 μgl^{-1} was reported and a concentration of 0.001 μgl^{-1} at site 5 and site 8. The other sites were reported to be below MRV.

(d) VOCs and SVOCs

All Volatile and Semi Volatile Organic Compounds analysed were found to be below MRV at all sites, with the exception of toluene which has a reported value of 0.11μgl^{-1} at site 8. This value is well below the relevant EQS set at 40 μgl^{-1}.

(e) Phenols

All phenols measured were reported as below the MRV (1 μgl^{-1}) for all samples.

3.3 Sediment Analysis Results

3.3.1 Granulometric analysis

Granulometric analysis indicated that five of the six sampling locations (three sites intertidal and three subtidal) on the Witham demonstrate similar substrate types, characterised predominantly by fine silt and clay substrates. The subtidal site at Corporation Point exhibited a dominance of fine sand and coarser sand types. The sediment type is reflected in the abundance of sediment-bound metals found at each site.

3.3.2 Metals

The Threshold Effects Level (TEL) for arsenic was exceeded at all six survey sites. The TEL of a substance is the concentration below which sediment-associated chemicals are not considered to represent significant hazards to aquatic organisms. The sites dominated by fine sediments all exhibited higher levels of sediment-bound metals with chromium, copper, lead and nickel exceeding their respective TELs. Furthermore, the TEL for zinc was exceeded only at the subtidal survey site at Hobhole Drain. No sediment-bound metal concentrations exceeded the Probable Effect Level (PEL); the PEL represents the lowest concentration of a substance that is known to have an adverse impact on aquatic organisms.

3.3.3 Hydrocarbons

A number of sediment-bound Poly Aromatic Hydrocarbons (PAH) were elevated above their respective TELs, with Naphthalene recorded in both the sub- and intertidal sediments at Hobhole Drain above the associated PEL level. Naphthalene is a common compound found in industrialized areas and its high abundance in sediments at Boston would not be considered unusual. All sites exhibit sediment PAHs elevated above the TEL and there appear to be no obvious trends regarding distance from the docks or location of the sites along the tidal gradient.

4 Conclusions and Recommendations

Conclusions

- All physiochemical parameters were recorded within expected levels. Depressed salinities recorded in winter are likely to be caused by increased freshwater flows preceding the survey
- Overall, water quality appeared to be good, with a single EQS exceeded for Iron at site 2.
- No PELs were exceeded in sediment chemistry analysis, although arsenic, chromium, copper, lead, nickel and zinc TELs were exceeded, principally at sites with a predominance of fine sediments.
- Contamination of the sediment would be expected in a estuary with a working dock and associated industry

Recommendations

- All in-channel activities within the Witham Estuary have the potential to directly affect water quality through the input of pollutants, modification of hydrological conditions and increase in boat traffic associated with developments in the aquatic environment.
- Disturbance of the sediments may re-suspend sediment-bound material into the water column, making contaminants available in the water column.
- Despite the findings of the current study, water quality data within the Witham Estuary remains temporally and spatially limited. Prior to an Environmental Impact Assessment, further baseline monitoring would be necessary to fully quantitatively assess the potential impacts on water quality from any proposed in-channel activities.

5 References

CCME (1999). Canadian Sediment Quality Guidelines for the Protection of Aquatic Life: Summary Tables. In: Canadian Environmental Quality Guidelines, 1999. Canadian Council of Ministers for the Environment, Winnipeg.

Lee Elliott, I. 2010. Marine Benthic Invertebrate Summary Report. Jacobs Report for the Environment Agency.

UKMarineSAC (2007). UK Marine SAC, 2008. [Online]
Available at: http://www.ukmarinesac.org.uk [accessed 23 May 2008].

6 Appendix A – Water Quality and Sediment Sampling Sites Locations

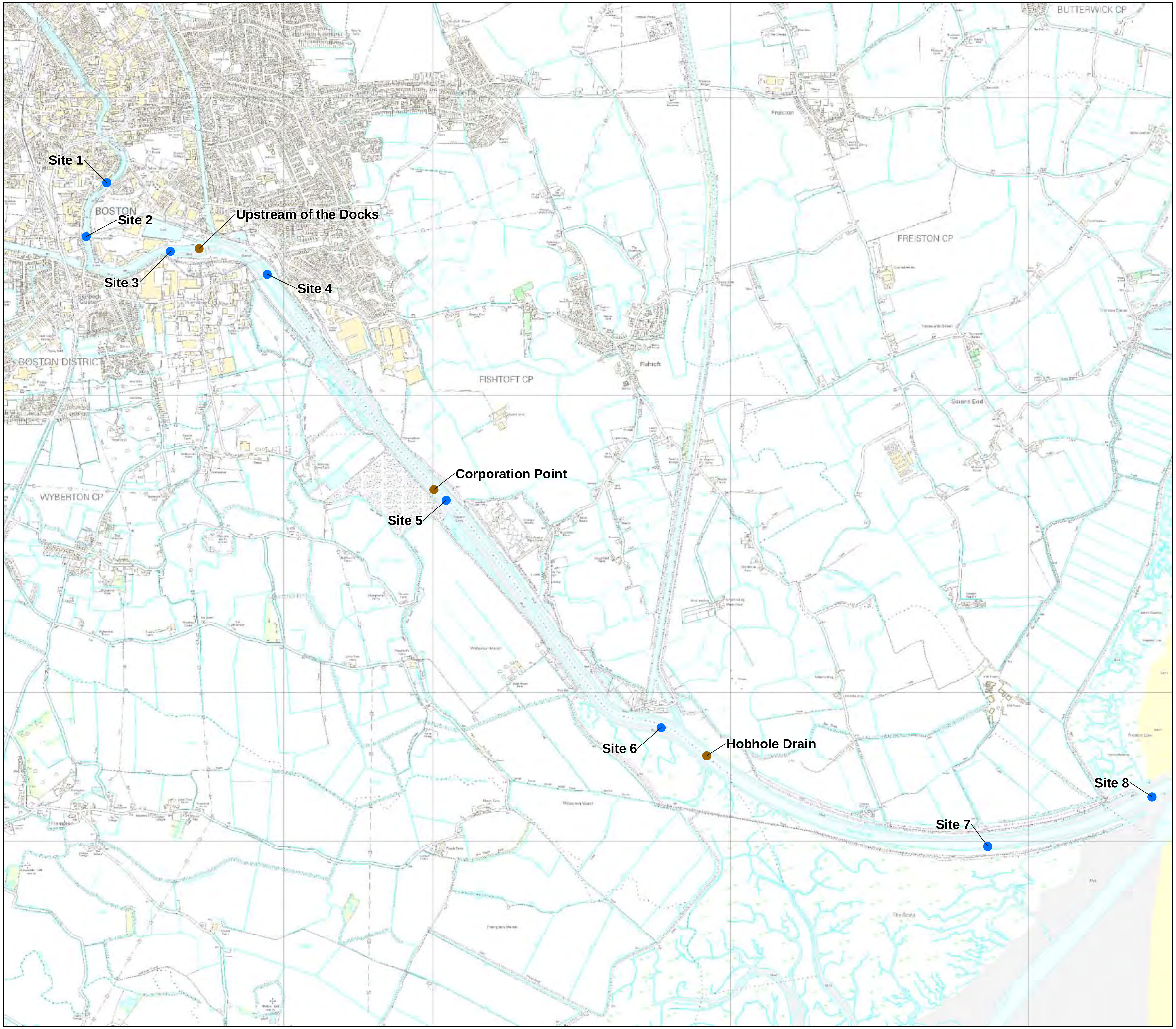

FIGURE 01

Legend

- Water Quality Sampling Sites
- Sediment Sampling Sites

N
W E
S

Environment Agency

Project

Boston Barrier and Haven Works

Title

Water Quality and Sediment Chemistry Sampling Locations

Scale 1:2500 (A3)	**Date** Mar 2011	**Ref.** B1377500_EC_WQ_01
Drawn AD	**Checked** JB	**Approved** SW

7 Appendix B – Water Quality Results

Table B 1: Oxygen Demand and Nutrients data.

				Site	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8
				Time	08:24	08:53	09:08	09:26	09:44	10:01	10:18	10:31
				Date	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10
Analyte	*Units*	*MRV*	*EQS*	*Accreditation*								
BOD 5 Day ATU	mg/l	1		UKAS	3.3	<2.90	<2.90	<2.90	3.5	3.5	<2.90	3.4
Chemical Oxygen Demand (COD)	mg/l	300		None	<300	<300	<300	<300				
Ammoniacal Nitrogen as N	mg/l	0.01		UKAS	0.096	0.142	0.156	0.141	0.096	0.036	0.016	0.015
Nitrite as N	mg/l	0.004		UKAS	0.0497	0.0501	0.0507	0.0518	0.0449	0.028	0.0101	0.0097
Nitrogen, Total Oxidised as N	mg/l	0.2		UKAS	7.65	7.54	7.61	7.57	3.83	2.26	0.59	0.58
Orthophosphate, reactive as P	mg/l	0.02		UKAS	0.046	0.052	0.069	0.076	0.047	0.024	<0.0200	<0.0200
Silicate, reactive as SiO2	mg/l	0.2		UKAS	0.43	0.46	0.54	0.59	0.23	<0.200	<0.200	<0.200
Chlorophyll, Acetone Extract	ug/l	0.5		UKAS	15.9	14.2	14.4	11.9	19.4	22.8	18.4	19.9
Nitrate as N	mg/l	0.005		UKAS	7.6	7.49	7.56	7.52	3.79	2.23	0.58	0.57

Table B 2: Heavy Metals.

				Site	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8
				Time	08:24	08:53	09:08	09:26	09:44	10:01	10:18	10:31
				Date	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10
Analyte	*Units*	*MRV*	*EQS*	*Accreditation*								
Arsenic	ug/l	1	25	UKAS	<1.00	1.4	1.1	1.1	1.5	1.5	1.4	1.5
Vanadium	ug/l	20	100	UKAS	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0
Cadmium	ug/l	0.04	0.6	UKAS	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Copper	ug/l	0.2	5	UKAS	1.92	2.03	1.5	1.52	1.22	1.05	0.76	0.74
Lead	ug/l	0.04	7.2	UKAS	1.12	2.65	1.45	1.2	0.946	1.19	0.971	0.82
Nickel	ug/l	0.3	20	UKAS	2.59	2.83	2.58	2.51	1.64	1.41	0.97	1.1
Zinc	ug/l	0.4	40	UKAS	5.27	8.06	4.47	4.05	2.93	3.66	2.41	2.38
Iron	ug/l	100	1000	UKAS	381	1130	567	421	396	490	369	345
Mercury	ug/l	0.01	0.07	UKAS	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Chromium	ug/l	0.5		UKAS	<0.500	1.4	0.6	0.5	<0.50	0.6	0.5	<0.50

Table B 3: PAHs

				Site	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8
				Time	08:24	08:53	09:08	09:26	09:44	10:01	10:18	10:31
				Date	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10
Analyte	*Units*	*MRV*	*EQS*	*Accreditation*								
Naphthalene	ug/l	0.01	1.2	UKAS	<0.010	<0.011	<0.011	<0.011	0.015	0.012	<0.010	<0.010
Hexachlorobenzene	ug/l	1	0.05	None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Hexachlorobutadiene	ug/l	1.5	0.6	None	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
Hexachlorocyclopentadiene	ug/l	1.5		None	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
Hexachloroethane	ug/l	2		None	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
1,2,4-Trichlorobenzene	ug/l	1	0.4	None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2-Chloronaphthalene	ug/l	1		None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
4-Bromophenyl phenyl ether	ug/l	1		None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00

Table B 4: Organotins

				Site	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8
				Time	08:24	08:53	09:08	09:26	09:44	10:01	10:18	10:31
				Date	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10
Analyte	*Units*	*MRV*	*EQS*	*Accreditation*								
Cyclohexyl Tin as Cation	ug/l	0.002		UKAS	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Dibutyl Tin as Cation	ug/l	0.0005		UKAS	0.0037	<0.0006	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0036
Dioctyl Tin as Cation	ug/l	0.002		None	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Diphenyl Tin as Cation	ug/l	0.001		None	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Monobutyl Tin as Cation	ug/l	0.001		UKAS	0.003	0.003	<0.0010	<0.0010	0.001	<0.0010	<0.0010	0.001
Monooctyl Tin as Cation	ug/l	0.0005		None	<0.0005	<0.0006	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Tetrabutyl Tin as Cation	ug/l	0.0005		UKAS	<0.0005	<0.0006	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Tetraphenyl Tin as Cation	ug/l	0.003		None	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Tributyl Tin as Cation	ug/l	0.0005	0.0015	UKAS	<0.0005	<0.0006	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Triphenyl Tin as Cation	ug/l	0.002	0.008	UKAS	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020

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Table B 5: VOCs and SVOCs

				Site	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8
				Time	08:24	08:53	09:08	09:26	09:44	10:01	10:18	10:31
				Date	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10
Analyte	***Units***	***MRV***	***EQS***	***Accreditation***								
1,1,1-Trichloroethane	ug/l	0.1	100	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
1,1,2-Trichloroethane	ug/l	0.5	300	UKAS	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
1,1-Dichloroethane	ug/l	0.1		UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
1,1-Dichloroethylene :- {1,1-Dichloroethene}	ug/l	0.1		UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
1,1-Dichloropropylene :- {1,1-Dichloropropene}	ug/l	0.1		UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
1,2,3-Trichloropropane	ug/l	0.5		UKAS	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
1,2-Dibromo-3-chloropropane	ug/l	0.1		UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
1,2-Dibromoethane	ug/l	0.1		UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
1,2-Dichlorobenzene	ug/l	0.1		UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
1,2-Dichloroethane	ug/l	0.1	10	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
1,2-Dichloropropane	ug/l	0.1		UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
1,3-Dichlorobenzene	ug/l	0.5		UKAS	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
1,3-Dichloropropane	ug/l	0.1		UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
1,4-Dichlorobenzene	ug/l	0.1		UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
2,2-Dichloropropane	ug/l	0.1		None	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
2-Chlorotoluene {1-Chloro-2-methylbenzene}	ug/l	0.1		UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
3-Chlorotoluene {1-Chloro-3-methylbenzene}	ug/l	0.1		UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
4-Chlorotoluene {1-Chloro-4-methylbenzene}	ug/l	0.1		UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
4-Isopropyltoluene {4-methyl-Isopropylbenzene}	ug/l	0.1		UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Bromobenzene	ug/l	0.1		UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Bromochloromethane	ug/l	0.1		UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Bromodichloromethane	ug/l	0.1		UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Bromoform {Tribromomethane}	ug/l	0.1		UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Carbon tetrachloride {Tetrachloromethane}	ug/l	0.1	12	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Chlorobenzene	ug/l	0.1		UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Chlorodibromomethane	ug/l	0.1		UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Chloroform {Trichloromethane}	ug/l	0.1	2.5	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Dibromomethane	ug/l	0.1		UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Dichloromethane {Methylene Dichloride}	ug/l	0.5	20	UKAS	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
Ethylbenzene	ug/l	0.1	20	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Isopropylbenzene	ug/l	0.1		None	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Styrene {Vinylbenzene}	ug/l	1	50	UKAS	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Tetrachloroethylene :- {Perchloroethylene}	ug/l	0.1	10	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Toluene :- {Methylbenzene}	ug/l	0.1	40	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	0.11
Trichloroethylene :- {Trichloroethene}	ug/l	0.1	10	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
cis-1,2-Dichloroethylene :- {cis-1,2-Dichloroethene}	ug/l	0.1		UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
cis-1,3-Dichloropropylene :- {cis-1,3-Dichloropropene}	ug/l	0.1		UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
trans-1,2-Dichloroethylene :- {trans-1,2-Dichloroethene}	ug/l	0.1		UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
trans-1,3-Dichloropropylene :- {trans-1,3-Dichloropropene}	ug/l	0.1		UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100

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Table B 6: Phenols

Analyte	Units	MRV	EQS	Accreditation	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8
				Time	08:24	08:53	09:08	09:26	09:44	10:01	10:18	10:31
				Date	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10
2,4-Dichlorophenol	ug/l	1	20	None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2,4-Dimethylphenol {2,4-Xylenol}	ug/l	1		None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2,3,4,6-Tetrachlorophenol	ug/l	1		None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2,3,5,6-Tetrachlorophenol	ug/l	1		None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2,4,5-Trichlorophenol	ug/l	1		None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2,4,6-Trichlorophenol	ug/l	1		None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2-Chlorophenol	ug/l	1	50	None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
4-Chloro-3-methylphenol {p-Chloro-m-cresol}	ug/l	1	40	None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Pentachlorophenol	ug/l	1	0.4	None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00

8 Appendix C - Sediment Chemistry Results

Table C 1: Granulometric Analysis

		Site	Hobhole Drain		Corporation Pt		Docks	
			Subtidal	Intertidal	Subtidal	Intertidal	Subtidal	Intertidal
		Date	29/04/10	29/04/10	29/04/10	29/04/10	29/04/10	29/04/10
		Time	06:41	06:57	07:21	07:32	08:24	08:37
Analyte	**Units**	**MRV**						
Boron, water soluble : Dry Wt	mg/kg	1	6.05	7.84	2.06	7.23	6.58	7.33
Carbon : Dry Wt	%	0.4	2.63	2.36	<0.400	2.44	1.90	2.32
Carbon, Organic : Dry Wt as C	%	0.4	1.17	1.20	<0.400	0.97	0.96	1.02
Grain Size : 4000 to 7999 microns	%	0	0.00	0.00	0.00	0.00	0.00	0.00
Grain Size Fraction : < 20 microns	%	0	42.40	38.10	0.00	47.00	29.20	42.30
Grain Size Fraction : < 63 microns	%	0	64.50	59.50	0.01	68.70	49.90	66.70
Grain Size Fraction : > 8000 microns	%	0	0.00	0.00	0.00	0.00	0.00	0.00
Grain Size Fraction : 1000 to 2000 microns	%	0	0.00	0.00	0.82	0.00	0.18	0.12
Grain Size Fraction : 125 to 249 microns	%	0	11.10	12.50	48.80	7.54	14.00	7.80
Grain Size Fraction : 2000 to 3999 microns	%	0	0.00	0.00	0.00	0.00	0.00	0.00
Grain Size Fraction : 250 to 499 microns	%	0	0.74	2.56	27.00	2.37	3.16	0.63
Grain Size Fraction : 500 to 999 microns	%	0	0.00	0.35	5.59	2.03	1.75	0.95
Grain Size Fraction : 63 to 125 microns	%	0	23.70	25.20	17.80	18.80	31.00	23.90
Grain Size Inclusive Kurtosis	mm	-12	0.58	0.57	0.50	0.57	0.52	0.57
Grain Size Inclusive Mean	mm	0	0.03	0.03	0.20	0.02	0.04	0.02
Inclusive Graphic Skewness :- {SKI}	Unitless	-1	-0.29	-0.38	0.12	-0.09	-0.47	-0.31
Kurtosis	Unitless	-12	1.96	9.98	14.30	34.70	23.10	48.50
Particle Diameter : Mean	mm	0	0.05	0.07	0.24	0.07	0.09	0.06
Particle Diameter : Median	mm	0	0.03	0.05	0.20	0.03	0.06	0.03
Sorting Coefficient	Unitless	-3	2.17	2.24	0.77	2.27	2.18	2.15
Dry Solids @ 30°C	%	0.5	58.90	55.20	78.90	64.50	54.40	51.40

Table C 2: Heavy Metals

Analyte	Units	Site	Hobhole Drain		Corporation Pt		Docks	
			Subtidal	Intertidal	Subtidal	Intertidal	Subtidal	Intertidal
		Date	29/04/10	29/04/10	29/04/10	29/04/10	29/04/10	29/04/10
		Time	06:41	06:57	07:21	07:32	08:24	08:37
Analyte	Units	MRV						
Mercury : Dry Wt	mg/kg	0.001	0.11	0.08	0.00	0.06	0.06	0.06
Aluminium, HF Digest : Dry Wt	mg/kg	0.4	55300.00	53000.00	15300.00	50700.00	48400.00	52800.00
Iron, HF Digest : Dry Wt	mg/kg	0.3	33100.00	30600.00	14500.00	28900.00	26600.00	29100.00
Arsenic, HF Digest : Dry Wt	mg/kg	0.1	20.50	14.80	10.30	14.60	11.10	12.50
Cadmium, HF Digest : Dry Wt	mg/kg	0.01	0.27	0.26	0.03	0.18	0.18	0.20
Chromium, HF Digest : Dry Wt	mg/kg	0.05	82.00	71.90	15.50	77.60	58.70	59.40
Copper, HF Digest : Dry Wt	mg/kg	0.1	37.20	34.10	3.04	27.40	28.10	28.60
Lead, HF Digest : Dry Wt	mg/kg	0.2	58.60	43.70	12.30	43.20	35.30	40.20
Nickel, HF Digest : Dry Wt	mg/kg	0.3	30.50	27.30	5.01	26.30	24.20	24.70
Zinc, HF Digest : Dry Wt	mg/kg	0.2	135.00	120.00	27.30	111.00	95.60	113.00

Table C 3: PCBs

Analyte	Units	Site	Hobhole Drain		Corporation Pt		Docks	
			Subtidal	Intertidal	Subtidal	Intertidal	Subtidal	Intertidal
		Date	29/04/10	29/04/10	29/04/10	29/04/10	29/04/10	29/04/10
		Time	06:41	06:57	07:21	07:32	08:24	08:37
Analyte	Units	MRV	Subtidal	Intertidal	Subtidal	Intertidal	Subtidal	Intertidal
PCB 028 DW	ug/kg	0.1	0.40	0.26	<0.100	0.23	0.28	0.53
PCB 052 DW	ug/kg	0.1	0.34	<0.170	<0.100	<0.120	<0.100	<0.27
PCB 101 DW	ug/kg	0.1	0.36	0.24	<0.100	0.20	0.18	0.37
PCB 118 DW	ug/kg	0.1	0.34	0.25	<0.100	0.20	<0.130	0.35
PCB 138 DW	ug/kg	0.1	0.51	0.34	<0.100	0.33	0.19	0.37
PCB 153 DW	ug/kg	0.1	0.56	0.34	<0.100	0.32	0.26	0.47
PCB 180 DW	ug/kg	0.1	0.35	0.23	<0.100	0.140	0.13	0.23

Table C 4: PAHs

		Site	Hobhole Drain		Corporation Pt		Docks	
			Subtidal	Intertidal	Subtidal	Intertidal	Subtidal	Intertidal
		Date	29/04/10	29/04/10	29/04/10	29/04/10	29/04/10	29/04/10
		Time	06:41	06:57	07:21	07:32	08:24	08:37
Analyte	**Units**	**MRV**						
Acenaphthene : Dry Wt	ug/kg	2	45.20	43.80	4.10	19.50	31.00	39.70
Acenaphthylene : Dry Wt	ug/kg	2	30.40	10.70	<2.00	7.60	29.70	14.50
Anthracene : Dry Wt	ug/kg	2	91.20	59.40	<2.00	37.70	114.00	79.80
Benzo(a)anthracene : Dry Wt	ug/kg	2	206.00	146.00	4.40	105.00	285.00	228.00
Benzo(a)pyrene : Dry Wt	ug/kg	2	238.00	159.00	4.30	121.00	313.00	260.00
Benzo(b)fluoranthene : Dry Wt	ug/kg	10	305.00	203.00	<10.0	160.00	324.00	293.00
Benzo(ghi)perylene : Dry Wt	ug/kg	10	140.00	101.00	<10.0	78.20	141.00	136.00
Benzo(k)fluoranthene : Dry Wt	ug/kg	10	90.00	58.30	<10.0	44.90	95.90	92.00
Chrysene : Dry Wt	ug/kg	2	206.00	169.00	4.10	129.00	273.00	246.00
Dibenzo(ah)anthracene : Dry Wt	ug/kg	5	34.10	22.60	<5.00	17.30	35.60	34.80
Fluoranthene : Dry Wt	ug/kg	2	353.00	245.00	5.10	174.00	400.00	348.00
Fluorene : Dry Wt	ug/kg	10	74.90	66.50	<10.0	39.00	57.20	66.10
Indeno(123cd)pyrene Dry Wt	ug/kg	10	133.00	92.90	<10.0	72.40	139.00	131.00
Naphthalene : Dry Wt	ug/kg	30	1210.00	853.00	292.00	148.00	176.00	183.00
Phenanthrene : Dry Wt	ug/kg	10	364.00	352.00	<10.0	221.00	408.00	404.00
Pyrene : Dry Wt	ug/kg	2	323.00	220.00	7.30	156.00	358.00	309.00

Table C 5: Organotins

		Site	Hobhole Drain		Corporation Pt		Docks	
			Subtidal	Intertidal	Subtidal	Intertidal	Subtidal	Intertidal
		Date	29/04/10	29/04/10	29/04/10	29/04/10	29/04/10	29/04/10
		Time	06:41	06:57	07:21	07:32	08:24	08:37
Analyte	**Units**	**MRV**						
Dibutyl Tin : Dry Wt as cation	ug/kg	3	<4.00	<4.00	<3.00	<4.00	<4.00	<6.00
Dioctyl Tin : Dry Wt as cation	ug/kg	3	<4.00	<5.00	<3.00	<4.00	<4.00	<6.00
Diphenyl Tin : Dry Wt as cation	ug/kg	2	<3.00	<3.00	<2.00	<3.00	<3.00	<4.00
Tetrabutyl Tin : Dry Wt as cation	ug/kg	2	<3.00	<3.00	<2.00	<3.00	<3.00	<4.00
Tributyl Tin : Dry Wt as cation	ug/kg	3	<4.00	<5.00	<3.00	<4.00	<4.00	<6.00
Triphenyl Tin : Dry Wt as cation	ug/kg	2	<3.00	<3.00	<2.00	<3.00	<3.00	<4.00

Table C 6: OCPs

		Site	Hobhole Drain		Corporation Pt		Docks	
			Subtidal	Intertidal	Subtidal	Intertidal	Subtidal	Intertidal
		Date	29/04/10	29/04/10	29/04/10	29/04/10	29/04/10	29/04/10
		Time	06:41	06:57	07:21	07:32	08:24	08:37
Analyte	**Units**	**MRV**						
Aldrin DW	ug/kg	1	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
DDE -pp DW	ug/kg	2	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
DDT -op DW	ug/kg	1	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
DDT -pp DW	ug/kg	2	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
Dieldrin DW	ug/kg	3	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00
Endrin DW	ug/kg	2	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
HCBD DW	ug/kg	1	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
HCH -alpha DW	ug/kg	1	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
HCH -beta DW	ug/kg	1	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
HCH -delta DW	ug/kg	1	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
HCH -gamma DW	ug/kg	1	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Hexachlorobenzene DW	ug/kg	1	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Isodrin DW	ug/kg	2	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
TDE -pp DW	ug/kg	1	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00

Table C 7: VOCs

		Site	Hobhole Drain		Corporation Pt		Docks	
			Subtidal	Intertidal	Subtidal	Intertidal	Subtidal	Intertidal
		Date	29/04/10	29/04/10	29/04/10	29/04/10	29/04/10	29/04/10
		Time	06:41	06:57	07:21	07:32	08:24	08:37
Analyte	**Units**	**MRV**						
1,1,1,2-Tetrachloroethane : Dry Wt	ug/kg	2	<4.00	<4.00	<3.00	<4.00	<4.00	<5.00
1,1,1-Trichloroethane : Dry Wt	ug/kg	0.2	<0.400	<0.400	<0.300	<0.400	<0.400	<0.500
1,1,2,2-Tetrachloroethane : Dry Wt	ug/kg	3	<6.00	<7.00	<4.00	<5.00	<6.00	<7.00
1,1,2-Trichloroethane : Dry Wt	ug/kg	0.3	<0.600	<0.700	<0.400	<0.500	<0.600	<0.700
1,1-Dichloroethane : Dry Wt	ug/kg	0.2	<0.400	<0.400	<0.300	<0.400	<0.400	<0.500
1,1-Dichloroethylene : Dry Wt	ug/kg	1	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
1,1-Dichloropropylene : Dry Wt	ug/kg	0.6	<1.00	<1.00	<0.800	<1.00	<1.00	<1.00
1,2,3-Trichlorobenzene : Dry Wt	ug/kg	3	<6.00	<7.00	<4.00	<5.00	<6.00	<7.00
1,2,3-Trichloropropane : Dry Wt	ug/kg	1	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
1,2,3-Trimethylbenzene : Dry Wt	ug/kg	1	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
1,2,4-Trichlorobenzene : Dry Wt	ug/kg	5	<10.0	<10.0	<7.00	<9.00	<10.0	<10.00
1,2,4-Trimethylbenzene : Dry Wt	ug/kg	0.7	<1.00	<2.00	<1.00	<1.00	<1.00	<2.00
1,2-Dibromo-3-chloropropane : Dry Wt	ug/kg	2	<4.00	<4.00	<3.00	<4.00	<4.00	<5.00
1,2-Dibromoethane : Dry Wt	ug/kg	3	<6.00	<7.00	<4.00	<5.00	<6.00	<7.00
1,2-Dichlorobenzene : Dry Wt	ug/kg	2	<4.00	<4.00	<3.00	<4.00	<4.00	<5.00
1,2-Dichloroethane : Dry Wt	ug/kg	0.3	<0.600	<0.700	<0.400	<0.500	<0.600	<0.700
1,2-Dichloropropane : Dry Wt	ug/kg	0.5	<1.00	<1.00	<0.700	<0.900	<1.00	<1.00
1,2-Dimethylbenzene : Dry Wt {o-Xylene}	ug/kg	1	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
1,3,5-Trimethylbenzene : Dry Wt {Mesitylene}	ug/kg	0.5	<1.00	<1.00	<0.700	<0.900	<1.00	<1.00
1,3+1,4-Dimethylbenzenes : Dry Wt {m+p-Xylenes}	ug/kg	2	<4.00	<4.00	<3.00	<4.00	<4.00	<5.00
1,3-Dichlorobenzene : Dry Wt	ug/kg	1	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
1,3-Dichloropropane : Dry Wt	ug/kg	2	<4.00	<4.00	<3.00	<4.00	<4.00	<5.00
1,3-Dichloropropylene : Dry Wt	ug/kg	0.8	<4.00	<4.00	<2.00	<3.00	<4.00	<4.00
1,4-Dichlorobenzene : Dry Wt	ug/kg	0.5	<1.00	<1.00	<0.700	<0.900	<1.00	<1.00
2,2-Dichloropropane : Dry Wt	ug/kg	1	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
2-Chlorotoluene : Dry Wt {1-Chloro-2-methylbenzene}	ug/kg	0.7	<1.00	<2.00	<1.00	<1.00	<1.00	<2.00
3-Chlorotoluene : Dry Wt {1-Chloro-3-methylbenzene}	ug/kg	1	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
4-Chlorotoluene : Dry Wt {1-Chloro-4-methylbenzene}	ug/kg	1	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
Benzene : Dry Wt	ug/kg	1	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
Bromobenzene : Dry Wt	ug/kg	2	<4.00	<4.00	<3.00	<4.00	<4.00	<5.00
Bromochloromethane : Dry Wt	ug/kg	0.5	<1.00	<1.00	<0.700	<0.900	<1.00	<1.00
Bromodichloromethane : Dry Wt	ug/kg	0.5	<1.00	<1.00	<0.700	<0.900	<1.00	<1.00
Bromoform : Dry Wt {Tribromomethane}	ug/kg	2	<4.00	<4.00	<3.00	<4.00	<4.00	<5.00
Carbon tetrachloride : Dry Wt {Tetrachloromethane}	ug/kg	0.2	<0.400	<0.400	<0.300	<0.400	<0.400	<0.500
Chlorobenzene : Dry Wt	ug/kg	1	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
Chloroethane : Dry Wt	ug/kg	5	<10.0	<10.0	<7.00	<9.00	<10.0	<10.0
Chloroform : Dry Wt {Trichloromethane}	ug/kg	0.5	<1.00	<1.00	<0.700	<0.900	<1.00	<1.00
Chloromethane : Dry Wt {Methyl Chloride}	ug/kg	2	<4.00	<4.00	<3.00	<4.00	<4.00	<5.00
cis-1,2-Dichloroethylene : Dry Wt	ug/kg	1	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
cis-1,3-Dichloropropylene : Dry Wt	ug/kg	1	<2.00	<2.00	<1.00	<1.00	<2.00	<2.00
Dibromochloromethane : Dry Wt	ug/kg	3	<6.00	<7.00	<4.00	<5.00	<6.00	<7.00
Dibromomethane : Dry Wt	ug/kg	0.6	<1.00	<1.00	<0.800	<1.00	<1.00	<1.00
Ethylbenzene : Dry Wt	ug/kg	0.5	<1.00	<1.00	<0.700	<0.900	<1.00	<1.00
Isopropylbenzene : Dry Wt {Methylethylbenzene}	ug/kg	0.7	<1.00	<2.00	<1.00	<1.00	<1.00	<2.00
iso-Propyltoluene : Dry Wt	ug/kg	0.8	<2.00	<2.00	<1.00	<1.00	<2.00	<2.00
Methylene Chloride : Dry Wt	ug/kg	60	<120	<130	<82.0	<110	<130	<140
MTBE : Dry Wt {Methyl tert-butyl ether}	ug/kg	4	<8.00	<9.00	<5.00	<7.00	<9.0	<9.00
n-ButylBenzene : Dry Wt {1-Phenylbutane}	ug/kg	2	<4.00	<4.00	<3.00	<4.00	<4.00	<5.00
n-Propylbenzene : Dry Wt {1-phenylpropane}	ug/kg	0.6	<1.00	<1.00	<0.800	<1.00	<1.00	<1.00
sec-Butylbenzene : Dry Wt {1-Methylpropylbenzene}	ug/kg	0.6	<1.00	<1.00	<0.800	<1.00	<1.00	<1.00
Styrene : Dry Wt :- {Vinylbenzene}	ug/kg	0.5	<1.00	<1.00	<0.700	<0.900	<1.00	<1.00
tert-Butylbenzene : Dry Wt {(1,1-Dimethylethyl)benzene}	ug/kg	0.8	<2.00	<2.00	<1.00	<1.00	<2.00	<2.00
Tetrachloroethylene : Dry Wt {Perchloroethylene}	ug/kg	1	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
Toluene : Dry Wt {Methylbenzene}	ug/kg	3	<6.00	<7.00	<4.00	<5.00	<6.00	<7.00
trans-1,2-Dichloroethene : Dry Wt	ug/kg	1	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
trans-1,3-Dichloropropene : Dry Wt	ug/kg	1	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
Trichloroethylene : Dry Wt {Trichloroethene}	ug/kg	0.2	<0.400	<0.400	<0.300	<0.400	<0.400	<0.500
Trichlorofluoromethane : Dry Wt	ug/kg	0.3	<0.600	<0.700	<0.400	<0.500	<0.600	<0.700
Vinyl Chloride : Dry Wt {Chloroethylene}	ug/kg	2	<4.00	<4.00	<3.00	<4.00	<4.00	<5.00

Table C 8: Phenols

		Site	Hobhole Drain		Corporation Pt		Docks	
			Subtidal	Intertidal	Subtidal	Intertidal	Subtidal	Intertidal
		Date	29/04/10	29/04/10	29/04/10	29/04/10	29/04/10	29/04/10
		Time	06:41	06:57	07:21	07:32	08:24	08:37
Analyte	**Units**	**MRV**						
2,3,4,6-Tetrachlorophenol : Dry Wt	ug/kg	1000	<3000	<4000	<2000	<2000	<3000	<3000
2,4,5-Trichlorophenol : Dry Wt	ug/kg	1000	<3000	<4000	<2000	<2000	<3000	<3000
2,4-Dichlorophenol : Dry Wt	ug/kg	1000	<3000	<4000	<2000	<2000	<3000	<3000
2,4-Dinitrophenol : Dry Wt	ug/kg	1000	<3000	<4000	<2000	<2000	<3000	<3000
2-Nitrophenol : Dry Wt	ug/kg	1000	<3000	<4000	<2000	<2000	<3000	<3000
3,4-Dimethylphenol : Dry Wt {3,4-Xylenol}	ug/kg	1000	<3000	<4000	<2000	<2000	<3000	<3000
3,5-Dimethylphenol : Dry Wt {3,5-Xylenol}	ug/kg	1000	<3000	<4000	<2000	<2000	<3000	<3000
4-Chloro-3-methylphenol : Dry Wt {p-chloro-m-cresol}	ug/kg	1000	<3000	<4000	<2000	<2000	<3000	<3000
4-Methylphenol : Dry Wt {p-Cresol}	ug/kg	1000	<3000	<4000	<2000	<2000	<3000	<3000
Dinoseb : Dry Wt	ug/kg	1000	<3000	<4000	<2000	<2000	<3000	<3000
DNOC: Dry Wt	ug/kg	1000	<3000	<4000	<2000	<2000	<3000	<3000
Pentachlorophenol : Dry Wt	ug/kg	1000	<3000	<4000	<2000	<2000	<3000	<3000
Phenol : Dry Wt	ug/kg	1000	<3000	<4000	<2000	<2000	<3000	<3000

9 Appendix D - Raw Data

Raw Data reported from samples taken during the Water Quality survey on 20th of April 2010.

			Site	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8
			Time	08:24	08:53	09:08	09:26	09:44	10:01	10:18	10:31
			Date	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10	20/04/10
Analyte	***Units***	***MRV***	***Accreditation***								
BOD 5 Day ATU	mg/l	1	UKAS	3.3	<2.90	<2.90	<2.90	3.5	3.5	<2.90	3.4
Chemical Oxygen Demand :- {COD}	mg/l	300	None	<300	<300	<300	<300				
Ammoniacal Nitrogen as N	mg/l	0.01	UKAS	0.096	0.142	0.156	0.141	0.096	0.036	0.016	0.015
Nitrite as N	mg/l	0.004	UKAS	0.0497	0.0501	0.0507	0.0518	0.0449	0.028	0.0101	0.0097
Nitrogen, Total Oxidised as N	mg/l	0.2	UKAS	7.65	7.54	7.61	7.57	3.83	2.26	0.59	0.58
Orthophosphate, reactive as P	mg/l	0.02	UKAS	0.046	0.052	0.069	0.076	0.047	0.024	<0.0200	<0.0200
Silicate, reactive as SiO2	mg/l	0.2	UKAS	0.43	0.46	0.54	0.59	0.23	<0.200	<0.200	<0.200
Chlorophyll, Acetone Extract	ug/l	0.5	UKAS	15.9	14.2	14.4	11.9	19.4	22.8	18.4	19.9
Arsenic	ug/l	1	UKAS	<1.00	1.4	1.1	1.1	1.5	1.5	1.4	1.5
Vanadium	ug/l	20	UKAS	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0
Cadmium	ug/l	0.04	UKAS	<0.0400	<0.0400	<0.0400	<0.0400	<0.0400	<0.0400	<0.0400	<0.0400
Copper	ug/l	0.2	UKAS	1.92	2.03	1.5	1.52	1.22	1.05	0.76	0.74
Lead	ug/l	0.04	UKAS	1.12	2.65	1.45	1.2	0.946	1.19	0.971	0.82
Nickel	ug/l	0.3	UKAS	2.59	2.83	2.58	2.51	1.64	1.41	0.97	1.1
Zinc	ug/l	0.4	UKAS	5.27	8.06	4.47	4.05	2.93	3.66	2.41	2.38
Iron	ug/l	100	UKAS	381	1130	567	421	396	490	369	345
Mercury	ug/l	0.01	UKAS	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Chromium	ug/l	0.5	UKAS	<0.500	1.4	0.6	0.5	<0.500	0.6	0.5	<0.500
Nitrate as N	mg/l	0.005	UKAS	7.6	7.49	7.56	7.52	3.79	2.23	0.58	0.57
Hydrocarbons Screen >C5 - C44	mg/l	0.2	None	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200
Cyclohexyl Tin as Cation	ug/l	0.002	UKAS	<0.00200	<0.00200	<0.00200	<0.00200	<0.00200	<0.00200	<0.00200	<0.00200
Dibutyl Tin as Cation	ug/l	0.0005	UKAS	0.0037	<0.000600	<0.000500	<0.000500	<0.000500	<0.000500	<0.000500	0.0036
Dioctyl Tin as Cation	ug/l	0.002	None	<0.00200	<0.00200	<0.00200	<0.00200	<0.00200	<0.00200	<0.00200	<0.00200
Diphenyl Tin as Cation	ug/l	0.001	None	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100
Monobutyl Tin as Cation	ug/l	0.001	UKAS	0.003	0.003	<0.00100	<0.00100	0.001	<0.00100	<0.00100	0.001
Monooctyl Tin as Cation	ug/l	0.0005	None	<0.000500	<0.000600	<0.000500	<0.000500	<0.000500	<0.000500	<0.000500	<0.000500
Tetrabutyl Tin as Cation	ug/l	0.0005	UKAS	<0.000500	<0.000600	<0.000500	<0.000500	<0.000500	<0.000500	<0.000500	<0.000500
Tetraphenyl Tin as Cation	ug/l	0.003	None	<0.00300	<0.00300	<0.00300	<0.00300	<0.00300	<0.00300	<0.00300	<0.00300
Tributyl Tin as Cation	ug/l	0.0005	UKAS	<0.000500	<0.000600	<0.000500	<0.000500	<0.000500	<0.000500	<0.000500	<0.000500
Triphenyl Tin as Cation	ug/l	0.002	UKAS	<0.00200	<0.00200	<0.00200	<0.00200	<0.00200	<0.00200	<0.00200	<0.00200
Naphthalene	ug/l	0.01	UKAS	<0.0100	<0.0110	<0.0110	<0.0110	0.015	0.012	<0.0100	<0.0100
1,2,4-Trichlorobenzene	ug/l	1	None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2,3,4,6-Tetrachlorophenol	ug/l	1	None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2,3,5,6-Tetrachlorophenol	ug/l	1	None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2,4,5-Trichlorophenol	ug/l	1	None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2,4,6-Trichlorophenol	ug/l	1	None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2,4-Dichlorophenol	ug/l	1	None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2,4-Dimethylphenol :- {2,4-Xylenol}	ug/l	1	None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2-Chloronaphthalene	ug/l	1	None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
2-Chlorophenol	ug/l	1	None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
4-Bromophenyl phenyl ether	ug/l	1	None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
4-Chloro-3-methylphenol :- {p-Chloro-m-cresol}	ug/l	1	None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
4-Chlorophenyl phenyl ether	ug/l	1	None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Hexachlorobenzene	ug/l	1	None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Hexachlorobutadiene	ug/l	1.5	None	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
Hexachlorocyclopentadiene	ug/l	1.5	None	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
Hexachloroethane	ug/l	2	None	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
Pentachlorophenol	ug/l	1	None	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
1,1,1-Trichloroethane	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
1,1,2-Trichloroethane	ug/l	0.5	UKAS	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
1,1-Dichloroethane	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
1,1-Dichloroethylene :- {1,1-Dichloroethene}	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
1,1-Dichloropropylene :- {1,1-Dichloropropene}	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
1,2,3-Trichloropropane	ug/l	0.5	UKAS	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
1,2-Dibromo-3-chloropropane	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
1,2-Dibromoethane	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
1,2-Dichlorobenzene	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
1,2-Dichloroethane	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
1,2-Dichloropropane	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
1,3-Dichlorobenzene	ug/l	0.5	UKAS	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
1,3-Dichloropropane	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
1,4-Dichlorobenzene	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
2,2-Dichloropropane	ug/l	0.1	None	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
2-Chlorotoluene :- {1-Chloro-2-methylbenzene}	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
3-Chlorotoluene :- {1-Chloro-3-methylbenzene}	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
4-Chlorotoluene :- {1-Chloro-4-methylbenzene}	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
4-Isopropyltoluene :- {4-methyl-Isopropylbenzene}	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Bromobenzene	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Bromochloromethane	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Bromodichloromethane	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Bromoform :- {Tribromomethane}	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Carbon tetrachloride :- {Tetrachloromethane}	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Chlorobenzene	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Chlorodibromomethane	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Chloroform :- {Trichloromethane}	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Dibromomethane	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Dichloromethane :- {Methylene Dichloride}	ug/l	0.5	UKAS	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
Ethylbenzene	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Isopropylbenzene	ug/l	0.1	None	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Styrene :- {Vinylbenzene}	ug/l	1	UKAS	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Tetrachloroethylene :- {Perchloroethylene}	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Toluene :- {Methylbenzene}	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	0.11
Trichloroethylene :- {Trichloroethene}	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
cis-1,2-Dichloroethylene :- {cis-1,2-Dichloroethene}	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
cis-1,3-Dichloropropylene :- {cis-1,3-Dichloropropene}	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
trans-1,2-Dichloroethylene :- {trans-1,2-Dichloroethene}	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
trans-1,3-Dichloropropylene :- {trans-1,3-Dichloropropene}	ug/l	0.1	UKAS	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100

Raw Data reported from the Sediment survey undertaken on the 29th of April 2010.

			Site	Hobhole Drain Subtidal	Hobhole Drain Intertidal	Corporation Pt Subtidal	Corporation Pt Intertidal	Docks Subtidal	Docks Intertidal
			Date	29/04/2010	29/04/2010	29/04/2010	29/04/2010	29/04/2010	29/04/2010
			Time	06:41	06:57	07:21	07:32	08:24	08:37
Analyte	**Units**	**MRV**	**Accreditation**						
Boron, Boiling water soluble : Dry Wt	mg/kg	1	UKAS	6.05	7.84	2.06	7.23	6.58	7.33
Carbon : Dry Wt	%	0.4	UKAS	2.63	2.36	<0.400	2.44	1.9	2.32
Carbon, Organic : Dry Wt as C	%	0.4	None	1.17	1.2	<0.400	0.97	0.96	1.02
Grain Size : 4000 to 7999 microns	%	0	UKAS	0	0	0	0	0	0
Grain Size Fraction : 1000 to 1999 microns	%	0	UKAS	0	0	0.82	0	0.18	0.12
Grain Size Fraction : 125 to 249 microns	%	0	UKAS	11.1	12.5	48.8	7.54	14	7.8
Grain Size Fraction : 2000 to 3999 microns	%	0	UKAS	0	0	0	0	0	0
Grain Size Fraction : 250 to 499 microns	%	0	UKAS	0.74	2.56	27	2.37	3.16	0.63
Grain Size Fraction : 500 to 999 microns	%	0	UKAS	0	0.35	5.59	2.03	1.75	0.95
Grain Size Fraction : 63 to 125 microns	%	0	UKAS	23.7	25.2	17.8	18.8	31	23.9
Grain Size Fraction : < 20 microns	%	0	UKAS	42.4	38.1	0	47	29.2	42.3
Grain Size Fraction : < 63 microns	%	0	UKAS	64.5	59.5	0.01	68.7	49.9	66.7
Grain Size Fraction : > 8000 microns	%	0	UKAS	0	0	0	0	0	0
Grain Size Inclusive Kurtosis	mm	-12	UKAS	0.578	0.566	0.497	0.574	0.518	0.574
Grain Size Inclusive Mean	mm	0	UKAS	0.025	0.029	0.203	0.022	0.038	0.024
Inclusive Graphic Skewness :- {SKI}	Unitless	-1	UKAS	-0.29	-0.38	0.12	-0.09	-0.47	-0.31
Kurtosis	Unitless	-12	UKAS	1.96	9.98	14.3	34.7	23.1	48.5
Particle Diameter : Mean	mm	0	UKAS	0.054	0.066	0.244	0.07	0.087	0.057
Particle Diameter : Median	mm	0	UKAS	0.034	0.045	0.197	0.025	0.063	0.033
Sorting Coefficient	Unitless	-3	UKAS	2.17	2.24	0.77	2.27	2.18	2.15
Mercury : Dry Wt	mg/kg	0.001	UKAS	0.108	0.076	0.003	0.058	0.055	0.063
Aluminium, HF Digest : Dry Wt	mg/kg	0.4	UKAS	55300	53000	15300	50700	48400	52800
Iron, HF Digest : Dry Wt	mg/kg	0.3	UKAS	33100	30600	14500	28900	26600	29100
Arsenic, HF Digest : Dry Wt	mg/kg	0.1	UKAS	20.5	14.8	10.3	14.6	11.1	12.5
Cadmium, HF Digest : Dry Wt	mg/kg	0.01	UKAS	0.272	0.262	0.032	0.184	0.18	0.199
Chromium, HF Digest : Dry Wt	mg/kg	0.05	UKAS	82	71.9	15.5	77.6	58.7	59.4
Copper, HF Digest : Dry Wt	mg/kg	0.1	UKAS	37.2	34.1	3.04	27.4	28.1	28.6
Lead, HF Digest : Dry Wt	mg/kg	0.2	UKAS	58.6	43.7	12.3	43.2	35.3	40.2
Nickel, HF Digest : Dry Wt	mg/kg	0.3	UKAS	30.5	27.3	5.01	26.3	24.2	24.7
Zinc : HF Digest : Dry Wt	mg/kg	0.2	UKAS	135	120	27.3	111	95.6	113
Aldrin : Dry Wt	ug/kg	1	UKAS	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
DDE -pp : Dry Wt	ug/kg	2	UKAS	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
DDT -op : Dry Wt	ug/kg	1	UKAS	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
DDT -pp : Dry Wt	ug/kg	2	UKAS	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
Dieldrin : Dry Wt	ug/kg	3	UKAS	<3.00	<3.00	<3.00	<3.00	<3.00	<3.00
Endrin : Dry Wt	ug/kg	2	UKAS	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
HCH -alpha : Dry Wt	ug/kg	1	UKAS	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
HCH -beta : Dry Wt	ug/kg	1	UKAS	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
HCH -delta : Dry Wt	ug/kg	1	UKAS	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
HCH -gamma : Dry Wt :- {Lindane}	ug/kg	1	UKAS	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Hexachlorobenzene : Dry Wt	ug/kg	1	UKAS	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Hexachlorobutadiene : Dry Wt	ug/kg	1	UKAS	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Isodrin : Dry Wt	ug/kg	2	UKAS	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
TDE - pp : Dry Wt	ug/kg	1	UKAS	<3.00	<1.00	<1.00	<1.00	<1.00	<1.00
Acenaphthene : Dry Wt	ug/kg	2	UKAS	45.2	43.8	4.1	19.5	31	39.7
Acenaphthylene : Dry Wt	ug/kg	2	None	30.4	10.7	<2.00	7.6	29.7	14.5
Anthracene : Dry Wt	ug/kg	2	UKAS	91.2	59.4	<2.00	37.7	114	79.8
Benzo(a)anthracene : Dry Wt	ug/kg	2	UKAS	206	146	4.4	105	285	228
Benzo(a)pyrene : Dry Wt	ug/kg	2	UKAS	238	159	4.3	121	313	260
Benzo(b)fluoranthene : Dry Wt	ug/kg	10	UKAS	305	203	<10.0	160	324	293
Benzo(ghi)perylene : Dry Wt	ug/kg	10	UKAS	140	101	<10.0	78.2	141	136
Benzo(k)fluoranthene : Dry Wt	ug/kg	10	UKAS	90	58.3	<10.0	44.9	95.9	92
Chrysene : Dry Wt	ug/kg	2	UKAS	206	169	4.1	129	273	246
Dibenzo(ah)anthracene : Dry Wt	ug/kg	5	UKAS	34.1	22.6	<5.00	17.3	35.6	34.8
Fluoranthene : Dry Wt	ug/kg	2	UKAS	353	245	5.1	174	400	348
Fluorene : Dry Wt	ug/kg	10	UKAS	74.9	66.5	<10.0	39	57.2	66.1
Indeno(1,2,3-c,d)pyrene : Dry Wt	ug/kg	10	UKAS	133	92.9	<10.0	72.4	139	131
Naphthalene : Dry Wt	ug/kg	30	None	1210	853	292	148	176	183
Phenanthrene : Dry Wt	ug/kg	10	UKAS	364	352	<10.0	221	408	404
Pyrene : Dry Wt	ug/kg	2	UKAS	323	220	7.3	156	358	309
PCB - 028 : Dry Wt	ug/kg	0.1	UKAS	0.4	0.26	<0.100	0.23	0.28	0.53
PCB - 052 : Dry Wt	ug/kg	0.1	UKAS	0.34	<0.170	<0.100	<0.120	<0.100	<0.270
PCB - 101 : Dry Wt	ug/kg	0.1	UKAS	0.36	0.24	<0.100	0.2	0.18	0.37
PCB - 118 : Dry Wt	ug/kg	0.1	UKAS	0.34	0.25	<0.100	0.2	<0.130	0.35
PCB - 138 : Dry Wt	ug/kg	0.1	UKAS	0.51	0.34	<0.100	0.33	0.19	0.37
PCB - 153 : Dry Wt	ug/kg	0.1	UKAS	0.56	0.34	<0.100	0.32	0.26	0.47
PCB - 180 : Dry Wt	ug/kg	0.1	UKAS	0.35	0.23	<0.100	0.14	0.13	0.23
Dibutyl Tin : Dry Wt as Cation	ug/kg	3	UKAS	<4.00	<4.00	<3.00	<4.00	<4.00	<6.00
Dioctyl Tin : Dry Wt as Cation	ug/kg	3	UKAS	<4.00	<5.00	<3.00	<4.00	<4.00	<6.00
Diphenyl Tin : Dry Wt as Cation	ug/kg	2	UKAS	<3.00	<3.00	<2.00	<3.00	<3.00	<4.00
Tetrabutyl Tin : Dry Wt as Cation	ug/kg	2	UKAS	<3.00	<3.00	<2.00	<3.00	<3.00	<4.00
Tributyl Tin : Dry Wt as Cation	ug/kg	3	UKAS	<4.00	<5.00	<3.00	<4.00	<4.00	<6.00
Triphenyl Tin : Dry Wt as Cation	ug/kg	2	UKAS	<3.00	<3.00	<2.00	<3.00	<3.00	<4.00
2,3,4,6-Tetrachlorophenol : Dry Wt	ug/kg	1000	UKAS	<3000	<4000	<2000	<2000	<3000	<3000
2,4,5-Trichlorophenol : Dry Wt	ug/kg	1000	UKAS	<3000	<4000	<2000	<2000	<3000	<3000
2,4-Dichlorophenol : Dry Wt	ug/kg	1000	UKAS	<3000	<4000	<2000	<2000	<3000	<3000
2,4-Dinitrophenol : Dry Wt	ug/kg	1000	UKAS	<3000	<4000	<2000	<2000	<3000	<3000
2-Nitrophenol : Dry Wt	ug/kg	1000	UKAS	<3000	<4000	<2000	<2000	<3000	<3000
3,4-Dimethylphenol : Dry Wt :- {3,4-Xylenol}	ug/kg	1000	UKAS	<3000	<4000	<2000	<2000	<3000	<3000
3,5-Dimethylphenol : Dry Wt :- {3,5-Xylenol}	ug/kg	1000	UKAS	<3000	<4000	<2000	<2000	<3000	<3000
4-Chloro-3-methylphenol : Dry Wt :- {p-chloro-m-cresol}	ug/kg	1000	UKAS	<3000	<4000	<2000	<2000	<3000	<3000
4-Methylphenol : Dry Wt :- {p-Cresol}	ug/kg	1000	UKAS	<3000	<4000	<2000	<2000	<3000	<3000
DNOC : Dry Wt	ug/kg	1000	UKAS	<3000	<4000	<2000	<2000	<3000	<3000

Raw Data reported from the Sediment survey undertaken on the 29th of April 2010 - CONTINUED.

			Site	Hobhole Drain		Corporation Pt		Docks	
				Subtidal	Intertidal	Subtidal	Intertidal	Subtidal	Intertidal
			Date	29/04/2010	29/04/2010	29/04/2010	29/04/2010	29/04/2010	29/04/2010
			Time	06:41	06:57	07:21	07:32	08:24	08:37
Analyte	*Units*	*MRV*	*Accreditation*						
Dinoseb : Dry Wt :- {2-Methyl-n-propyl-4,6-dinitrophenol}	ug/kg	1000	UKAS	<3000	<4000	<2000	<2000	<3000	<3000
Pentachlorophenol : Dry Wt	ug/kg	1000	UKAS	<3000	<4000	<2000	<2000	<3000	<3000
Phenol : Dry Wt	ug/kg	1000	UKAS	<3000	<4000	<2000	<2000	<3000	<3000
Resorcinol : Dry Wt :- {1,3-Dihydroxybenzene}	ug/kg	1000	UKAS	<3000	<4000	<2000	<2000	<3000	<3000
1,1,1,2-Tetrachloroethane : Dry Wt	ug/kg	2	UKAS	<4.00	<4.00	<3.00	<4.00	<4.00	<5.00
1,1,1-Trichloroethane : Dry Wt	ug/kg	0.2	UKAS	<0.400	<0.400	<0.300	<0.400	<0.400	<0.500
1,1,2,2-Tetrachloroethane : Dry Wt	ug/kg	3	UKAS	<6.00	<7.00	<4.00	<5.00	<6.00	<7.00
1,1,2-Trichloroethane : Dry Wt	ug/kg	0.3	UKAS	<0.600	<0.700	<0.400	<0.500	<0.600	<0.700
1,1-Dichloroethane : Dry Wt	ug/kg	0.2	UKAS	<0.400	<0.400	<0.300	<0.400	<0.400	<0.500
1,1-Dichloroethylene : Dry Wt	ug/kg	1	UKAS	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
1,1-Dichloropropylene : Dry Wt	ug/kg	0.6	UKAS	<1.00	<1.00	<0.800	<1.00	<1.00	<1.00
1,2,3-Trichlorobenzene : Dry Wt	ug/kg	3	UKAS	<6.00	<7.00	<4.00	<5.00	<6.00	<7.00
1,2,3-Trichloropropane : Dry Wt	ug/kg	1	UKAS	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
1,2,3-Trimethylbenzene : Dry Wt	ug/kg	1	UKAS	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
1,2,4-Trichlorobenzene : Dry Wt	ug/kg	5	UKAS	<10.0	<10.0	<7.00	<9.00	<10.0	<10.0
1,2,4-Trimethylbenzene : Dry Wt	ug/kg	0.7	UKAS	<1.00	<2.00	<1.00	<1.00	<1.00	<2.00
1,2-Dibromo-3-chloropropane : Dry Wt	ug/kg	2	UKAS	<4.00	<4.00	<3.00	<4.00	<4.00	<5.00
1,2-Dibromoethane : Dry Wt	ug/kg	3	UKAS	<6.00	<7.00	<4.00	<5.00	<6.00	<7.00
1,2-Dichlorobenzene : Dry Wt	ug/kg	2	UKAS	<4.00	<4.00	<3.00	<4.00	<4.00	<5.00
1,2-Dichloroethane : Dry Wt	ug/kg	0.3	UKAS	<0.600	<0.700	<0.400	<0.500	<0.600	<0.700
1,2-Dichloropropane : Dry Wt	ug/kg	0.5	UKAS	<1.00	<1.00	<0.700	<0.900	<1.00	<1.00
1,2-Dimethylbenzene : Dry Wt :- {o-Xylene}	ug/kg	1	UKAS	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
1,3,5-Trimethylbenzene : Dry Wt :- {Mesitylene}	ug/kg	0.5	UKAS	<1.00	<1.00	<0.700	<0.900	<1.00	<1.00
1,3-Dichlorobenzene : Dry Wt	ug/kg	1	UKAS	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
1,3-Dichloropropane : Dry Wt	ug/kg	2	UKAS	<4.00	<4.00	<3.00	<4.00	<4.00	<5.00
1,3-Dichloropropylene : Dry Wt	ug/kg	0.8	UKAS	<4.00	<4.00	<2.00	<3.00	<4.00	<4.00
1,4-Dichlorobenzene : Dry Wt	ug/kg	0.5	UKAS	<1.00	<1.00	<0.700	<0.900	<1.00	<1.00
2,2-Dichloropropane : Dry Wt	ug/kg	1	UKAS	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
2-Chlorotoluene : Dry Wt	ug/kg	0.7	UKAS	<1.00	<2.00	<1.00	<1.00	<1.00	<2.00
3-Chlorotoluene : Dry Wt :- {1-Chloro-3-methylbenzene}	ug/kg	1	UKAS	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
4-Chlorotoluene : Dry Wt :- {1-Chloro-4-methylbenzene}	ug/kg	1	UKAS	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
Benzene : Dry Wt	ug/kg	1	UKAS	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
Bromobenzene : Dry Wt	ug/kg	2	UKAS	<4.00	<4.00	<3.00	<4.00	<4.00	<5.00
Bromochloromethane : Dry Wt	ug/kg	0.5	UKAS	<1.00	<1.00	<0.700	<0.900	<1.00	<1.00
Bromodichloromethane : Dry Wt	ug/kg	0.5	UKAS	<1.00	<1.00	<0.700	<0.900	<1.00	<1.00
Bromoform : Dry Wt :- {Tribromomethane}	ug/kg	2	UKAS	<4.00	<4.00	<3.00	<4.00	<4.00	<5.00
Carbon tetrachloride : Dry Wt :- {Tetrachloromethane}	ug/kg	0.2	UKAS	<0.400	<0.400	<0.300	<0.400	<0.400	<0.500
Chlorobenzene : Dry Wt	ug/kg	1	UKAS	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
Chloroethane : Dry Wt	ug/kg	5	UKAS	<10.0	<10.0	<7.00	<9.00	<10.0	<10.0
Chloroform : Dry Wt :- {Trichloromethane}	ug/kg	0.5	UKAS	<1.00	<1.00	<0.700	<0.900	<1.00	<1.00
Chloromethane : Dry Wt :- {Methyl Chloride}	ug/kg	2	UKAS	<4.00	<4.00	<3.00	<4.00	<4.00	<5.00
Dibromochloromethane : Dry Wt	ug/kg	3	UKAS	<6.00	<7.00	<4.00	<5.00	<6.00	<7.00
Dibromomethane : Dry Wt	ug/kg	0.6	UKAS	<1.00	<1.00	<0.800	<1.00	<1.00	<1.00
Dimethylbenzene : Sum of (1,3- 1,4-) : Dry Wt	ug/kg	2	UKAS	<4.00	<4.00	<3.00	<4.00	<4.00	<5.00
Ethylbenzene : Dry Wt	ug/kg	0.5	UKAS	<1.00	<1.00	<0.700	<0.900	<1.00	<1.00
Isopropylbenzene : Dry Wt	ug/kg	0.7	UKAS	<1.00	<2.00	<1.00	<1.00	<1.00	<2.00
MTBE : Dry Wt :- {Methyl tert-butyl ether}	ug/kg	4	UKAS	<8.00	<9.00	<5.00	<7.00	<9.00	<9.00
Methylene Chloride : Dry Wt	ug/kg	60	None	<120	<130	<82.0	<110	<130	<140
Styrene : Dry Wt :- {Vinylbenzene}	ug/kg	0.5	UKAS	<1.00	<1.00	<0.700	<0.900	<1.00	<1.00
Tetrachloroethylene : Dry Wt :- {Perchloroethylene}	ug/kg	1	UKAS	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
Toluene : Dry Wt :- {Methylbenzene}	ug/kg	3	UKAS	<6.00	<7.00	<4.00	<5.00	<6.00	<7.00
Trichloroethylene : Dry Wt :- {Trichloroethene}	ug/kg	0.2	UKAS	<0.400	<0.400	<0.300	<0.400	<0.400	<0.500
Trichlorofluoromethane : Dry Wt	ug/kg	0.3	UKAS	<0.600	<0.700	<0.400	<0.500	<0.600	<0.700
Vinyl Chloride : Dry Wt :- {Chloroethylene}	ug/kg	2	UKAS	<4.00	<4.00	<3.00	<4.00	<4.00	<5.00
cis-1,2-Dichloroethylene : Dry Wt	ug/kg	1	UKAS	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
cis-1,3-Dichloropropylene : Dry Wt	ug/kg	1	UKAS	<2.00	<2.00	<1.00	<1.00	<2.00	<2.00
iso-Propyltoluene : Dry Wt	ug/kg	0.8	UKAS	<2.00	<2.00	<1.00	<1.00	<2.00	<2.00
n-ButylBenzene : Dry Wt :- {1-Phenylbutane}	ug/kg	2	UKAS	<4.00	<4.00	<3.00	<4.00	<4.00	<5.00
n-Propylbenzene : Dry Wt :- {1-phenylpropane}	ug/kg	0.6	UKAS	<1.00	<1.00	<0.800	<1.00	<1.00	<1.00
sec-Butylbenzene : Dry Wt :- {1-Methylpropylbenzene}	ug/kg	0.6	UKAS	<1.00	<1.00	<0.800	<1.00	<1.00	<1.00
tert-Butylbenzene : Dry Wt :- {(1,1-Dimethylethyl)benzene}	ug/kg	0.8	UKAS	<2.00	<2.00	<1.00	<1.00	<2.00	<2.00
trans-1,2-Dichloroethene : Dry Wt	ug/kg	1	UKAS	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
trans-1,3-Dichloropropylene : Dry Wt	ug/kg	1	UKAS	<2.00	<2.00	<1.00	<2.00	<2.00	<2.00
Dry Solids @ 30°C	%	0.5	None	58.9	55.2	78.9	64.5	54.4	51.4
Accreditation Assessment	No.	1	None	2	2	2	2	2	2

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